EDF Title: Knockdown Hopper Frame Design Revision

Project No.: 2000-096	Project Title: OU 1-10, Group 3

Problem Statement: ITR has selected a vacuum system to remove waste from a pair of buried storage tanks at the INEEL. The vacuum system moves waste from the tanks to a knockdown hopper, and thence to waste storage boxes underneath the knockdown hopper. The purpose of this design is to provide a structural frame for the knockdown hopper to position the hopper above the receiving waste boxes.

Design revisions have changed the original dimensions of the waste boxes and support frame. Also, a small jib crane has been added to the frame to facilitate waste box lid changes at the vacuum station. This analysis compares the previous calculations to the new information and makes minor modifications to the design to maintain sufficient build strength.

Summary of Conclusions: The new vacuum frame is 6' tall, 6' deep and 8' wide. The dimensional change required no structural change to meet AISC Allowable Stress Design code. A jib crane was added to the structure with a 10' reach and 500lb capacity. The crane required thicker cross braces to prevent buckling in a pinned connection model. The thicker cross braces also receive larger welds to meet AWS recommended minimums for base material thickness. Backing plates were added to the main beam at the jib crane attachment points. The backing plates reduce the possibility of local beam crushing or deformation at the load points.

Review and Approval Signatures:

	R/A	Printed Name	Signature	Date
Prepared by:		Kevin M. Shaber		10/20/03
Checked by:		KESLEY KIMMELL		10/21/03
Approval:		GARY MEEHAM		10/21/03

Distribution:

Professional Engineer's Stamp (if required)

Engineering Report

REVISION TO DESIGN OF SUPPORT FRAME FOR PM-2A KNOCKDOWN HOPPER

INTREPID Task No. 2000-096-12

17 October 2003

Prepared by: Kevin Shaber

TABLE OF CONTENTS

This report was prepared under the responsible charge of a Professional Engineer as indicated by the seal and signature below:

1.0 Project Description

This engineering evaluation studies the impacts of geometry changes and the addition of a jib crane to the vacuum system support frame. These modifications are necessary to accommodate a revised waste box geometry and lid change restrictions generated through the OU 1-10 PM-2A tank decontamination and dismantlement design review process.

Intrepid Technology & Resources (ITR) designed a vacuum system support frame to handle the loads associated with the vacuum system. This support frame provides room underneath the vacuum filter housing to put a DOT approved waste box for vacuum effluent. The support frame will be mounted on a concrete pad with a shield wall for radiation exposure mitigation. Initial design development is documented in, "Design of Support Frame for PM-2A Knockdown Hopper."

This evaluation does not change or recalculate the original design calculations. The original calculations are used as a basis from which the geometry and load changes are compared. The original RISA-3D structural model was re-used with the new geometry and loads added to the original design. Weld and joint studies were done comparatively as well.

2.0 Design Criteria

AISC 9th Edition, *Allowable Stress Design* (1999) was used in the RISA model to compare member stresses against allowable loads. The results are given as a fraction of the maximum allowable load. Omer Blodget's *Design of Weldments* was used for weld design. Most new weld evaluations were simply a comparison to the original design to ensure the modifications were bounded. One plate analysis was done using good engineering judgement and allowable stress limitations given in AISC 9th Edition, *Allowable Stress Design*, 1989.

3.0 Design Changes

The new structure basic dimensions are 6' deep, 6' tall, and 8' long. The dimensions calculated in the original RISA model were 6.3' deep, 5.25' tall, and 14' long. After the original calculations were made, the dimensions changed slightly but were still bounded within the original calculations. As span dimensions are reduced, the overall structure rigidity and load capacity will increase.

A jib crane is being added to the southwest corner of the vacuum support frame to facilitate waste box lid changes at the vacuum station. These lid changes were asked to be done under a weather enclosure and with a minimum of re-work. Changing box lids at the vacuum system facilitates both of these needs and eliminates the need for a specially designed vacuum lid for each waste box. The applied jib crane loads used were the vendor advertised reaction loads of 1685lbs at each mounting bracket.

Concentrated point loads on the support frame structure required the addition of bearing plates on the critical beams. These bearing plates will be welded in place to prevent local buckling or crushing of beams.

4.0 Results

The geometry changes to the support structure increased the load safety factor at all points. Primary loading was due to the vacuum system knockdown hopper dead weight acting on the non-triangulated north-south frame orientation. Because the primary north-south span and the cross beams were both shortened, the overall structure was strengthened. The height of the structure was increased, but this had a negligible effect on overall strength.

The addition of the jib crane required three minor modifications to remain within AISC allowable stress design limits. One cross brace on the south side exceeded allowable buckling loads. All cross braces were upgraded to 2"x2"x ¼" angle to accommodate increased compression. The RISA modeling software accepted this fix under only pinned end constraints. Considering that the cross braces are actually welded, the buckling load is more conservative still than calculated.

The jib crane attaches to the support structure with two mounting plates. A normal application would attach these mounting plates to an I-beam eliminating any local beam deformation at the mounting point. In this case the beams are tubular sections that may suffer local crushing under load. To prevent this, quarter-inch backing plates will be used at the bolting locations for each mounting plate. The quarter-inch backing plates are welded to the original beams to counter adverse shear loads. The backing plate effectively increases the thickness of the beam wall instead of being additive.

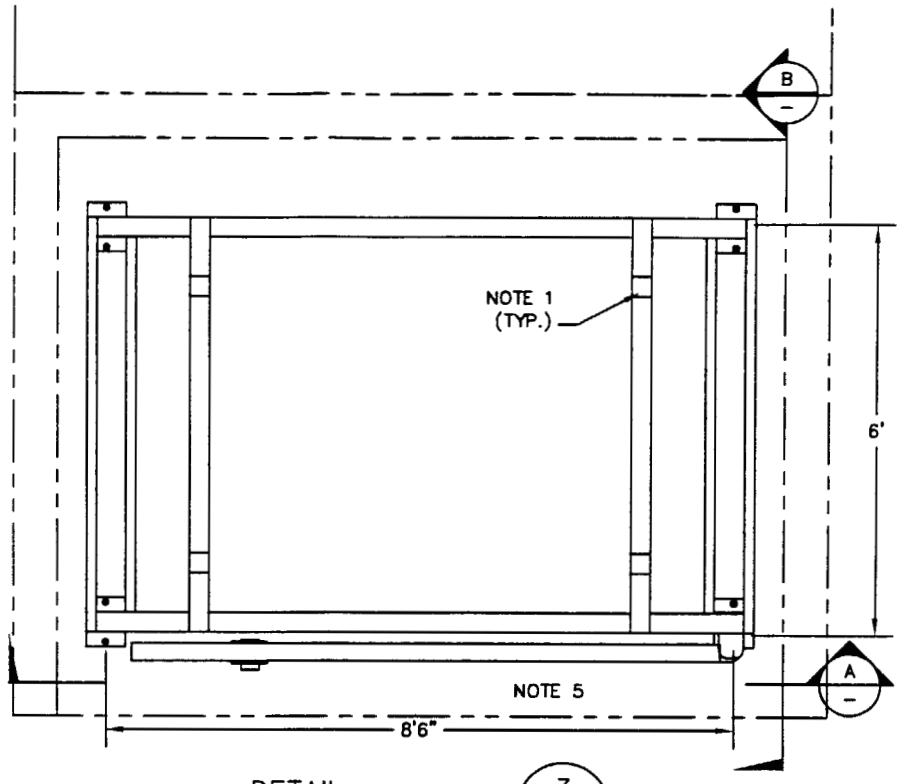
Two new weld evaluations were done to accommodate the material changes in the structure. Because the cross braces were increased to ¼" thick, the connection welds were increased to 3/16" fillets. These larger fillets are in line with the minimum recommended weld size for ¼" sections according to the AWS. Blodget states that a weld throat equal to the base metal thickness will out-pull the base metal under any loading. Based on this statement, weld sizes for the backing plates were made at 1x the base metal thickness (¼").

Bolts used to hang the jib crane on the support frame are manufacturer recommended to be ASTM grade A325. The maximum load transferred to the bolted connection will apply a stress much lower than the proof stress of an A325 bolt. Therefore, no minimum pre-load torque is required. However, a good standard practice will be to use lock-washers in the assembly and tighten the bolts to completely flatten the lock washers. This will help prevent potential loosening of the bolts due to system vibration. Care should be taken not to over tighten the bolts. Over tightening the bolts may lead to crushing of the support frame members.

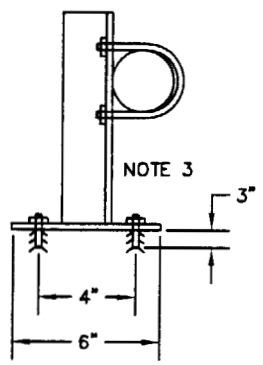
5.0 Appendix A: Design Drawings

6.0 Appendix B: Design Calculations

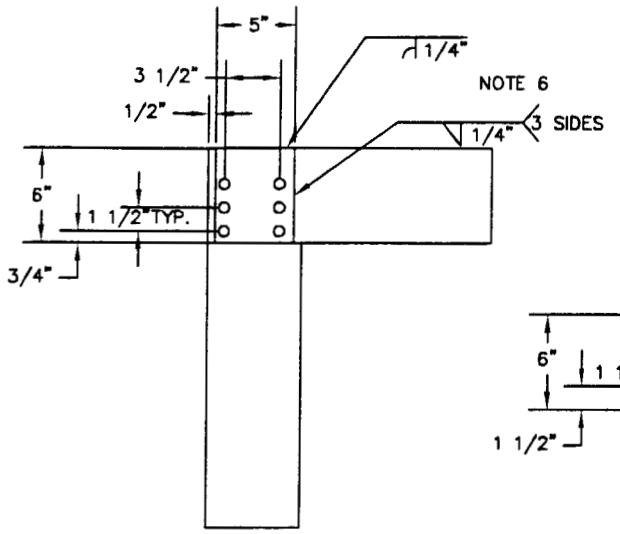
6.1 Revised RISA-3D Numeric Model



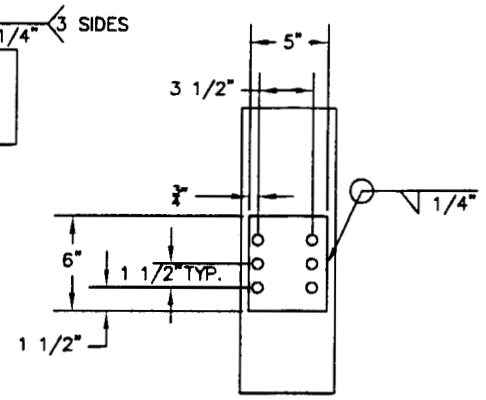
DETAIL 3 / M-10
VACUUM SUPPORT FRAME
PLAN VIEW
1:20



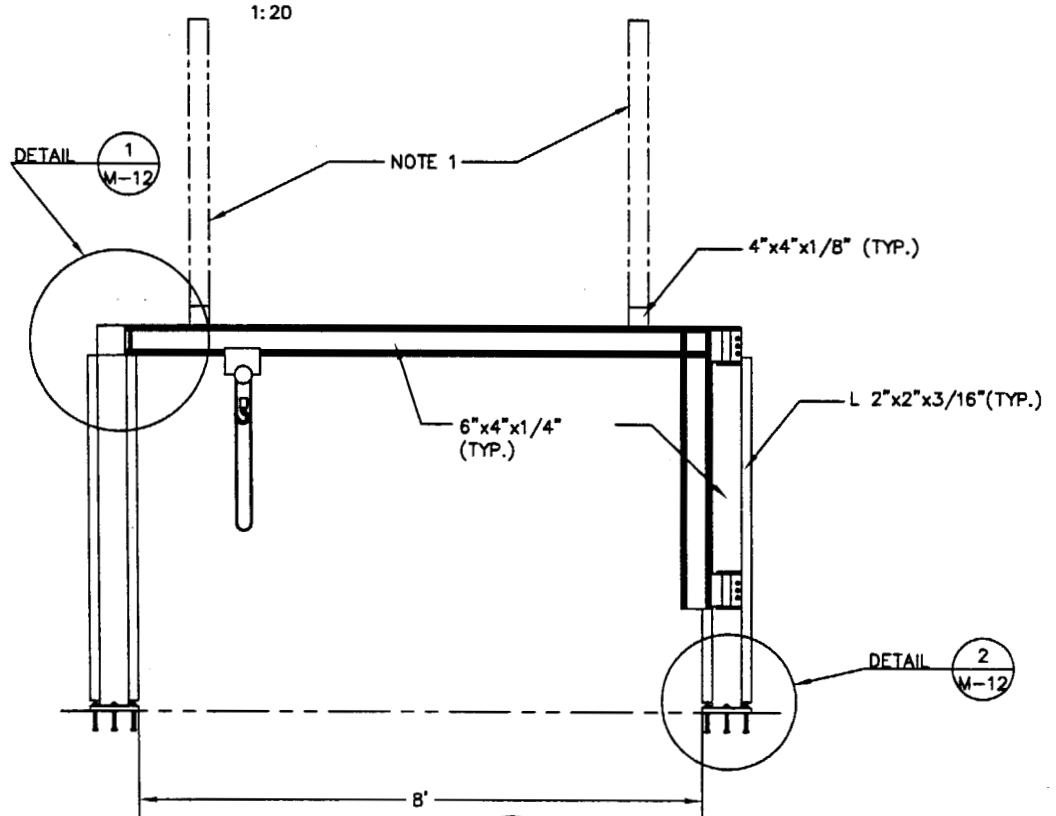
DETAIL 4 / M-10
PIPE SUPPORTS
1:4



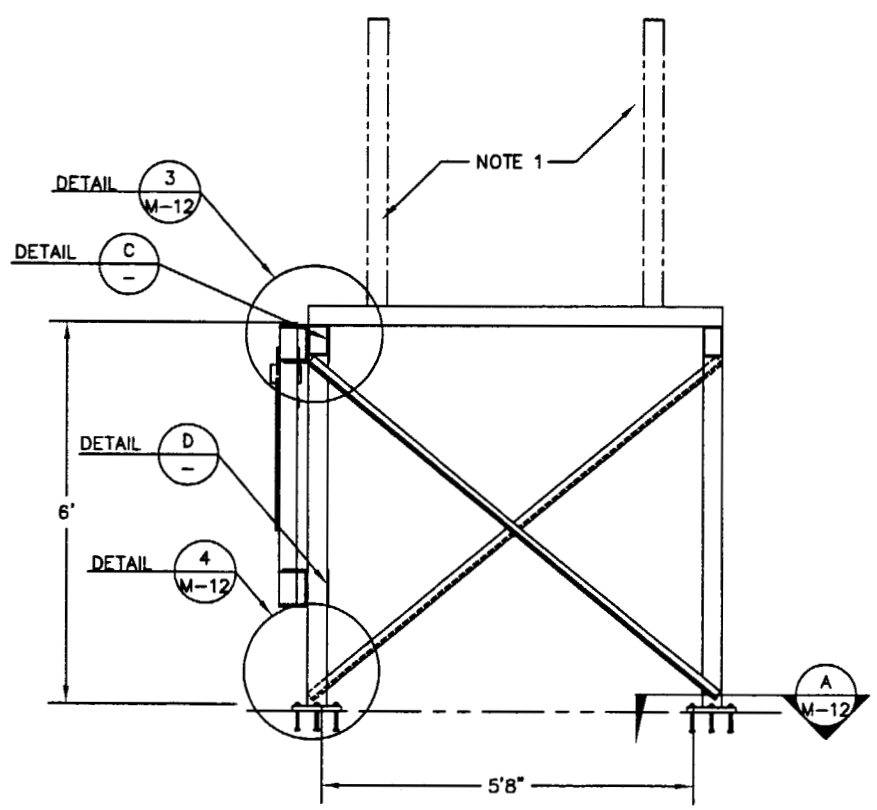
DETAIL C / –
BACKING PLATE
1:6



DETAIL D / –
BACKING PLATE
1:6



SECTION A / –
VACUUM SUPPORT FRAME
1:20
NOTE 4



SECTION B / –
VACUUM SUPPORT FRAME
1:20
NOTE 4

REV	DATE	DESCRIPTION	DESIGN	APP'D BY

NOTES

1) VACUUM FRAME SUPPORTS TO BE SUPPLIED WITH VACUUM SYSTEM AND ATTACHED AS SHOWN ON SHEET M-9.

2) EXACT POSITIONING OF VACUUM FRAME SUPPORT CROSS MEMBERS SHALL COMPLY WITH THE ACTUAL DIMENSIONS OF THE SUPPLIED VACUUM FRAME.

3) PIPE SUPPORTS WILL BE MADE WITH 1/4"X2" ANGLE WITH 6"x6" BASE PLATES. ATTACH PIPE USING APPROPRIATE U-BOLTS. ATTACH BASE PLATES TO FLOOR WITH 2 EA. 3/8" EMBEDDED CONCRETE WEDGE ANCHORS.

4) SHIELD WALLS NOT SHOWN FOR CLARITY.

5) JIB CRANE IS FOR USE WITH CHANGE OUT OF WASTE BOX LIDS.

6) BACKING PLATES ARE $\frac{1}{4}$" THICK WITH CONTINUOUS WELDS ABOUT THEIR CIRCUMFERENCE. IN THE CASE OF DETAIL C, WHERE A FILLET CANNOT BE USED ON THE TOP, A GROOVE WELD SHALL BE USED INSTEAD.

SCALE:

OU 1-10 TSF-26 VACUUM SUPPORT FRAME

intrepid technology & resources incorporated
501 W. BROADWAY, SUITE 200, IDAHO FALLS, ID 83402
(208)529-5337 FAX: (208)529-1014

M-11

DRAWN:		TASK ORDER NUMBER	
		2000-096	
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CHECKED:		DRAWING NUMBER	REV B
APPROVED:			
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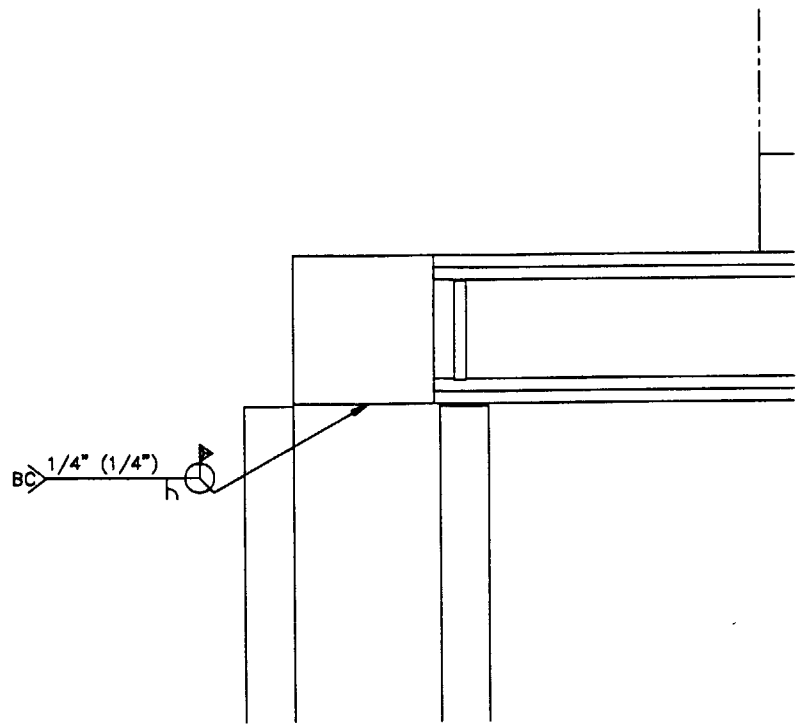
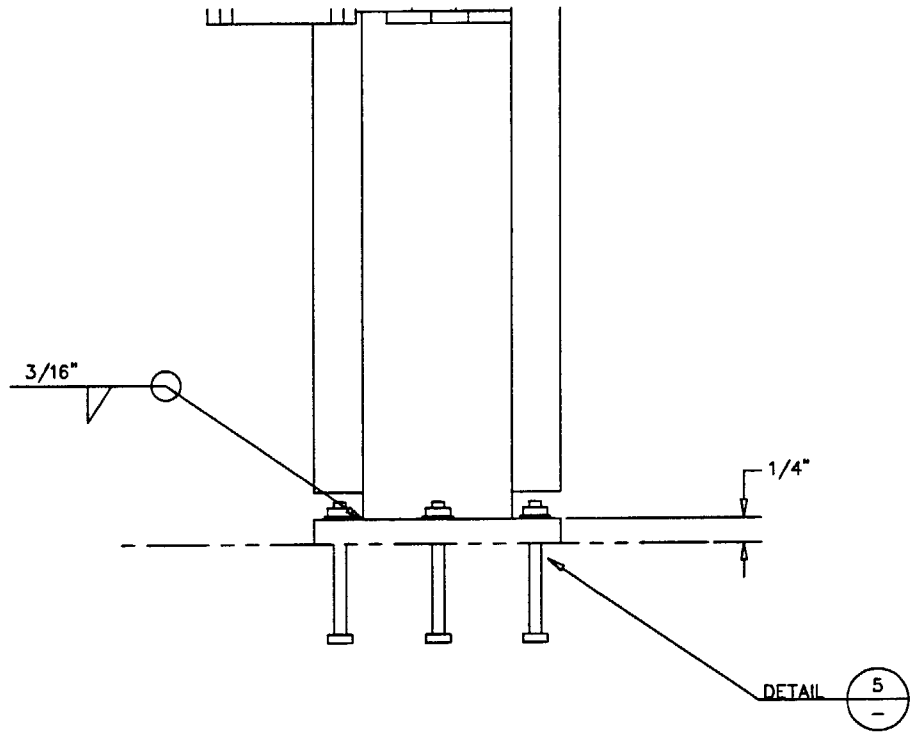
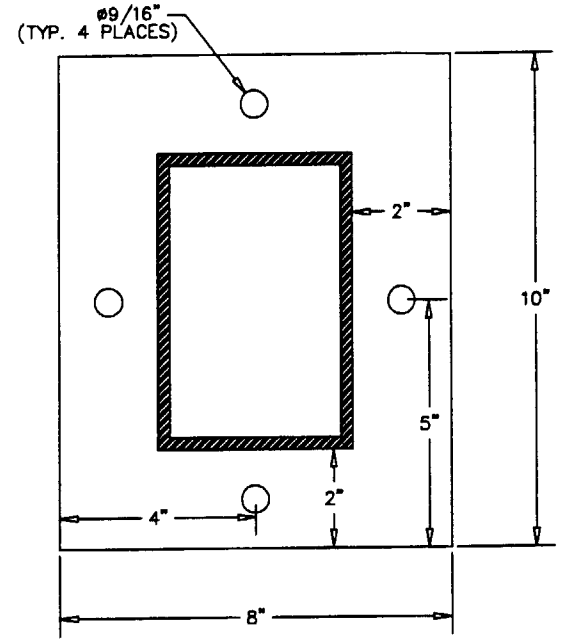


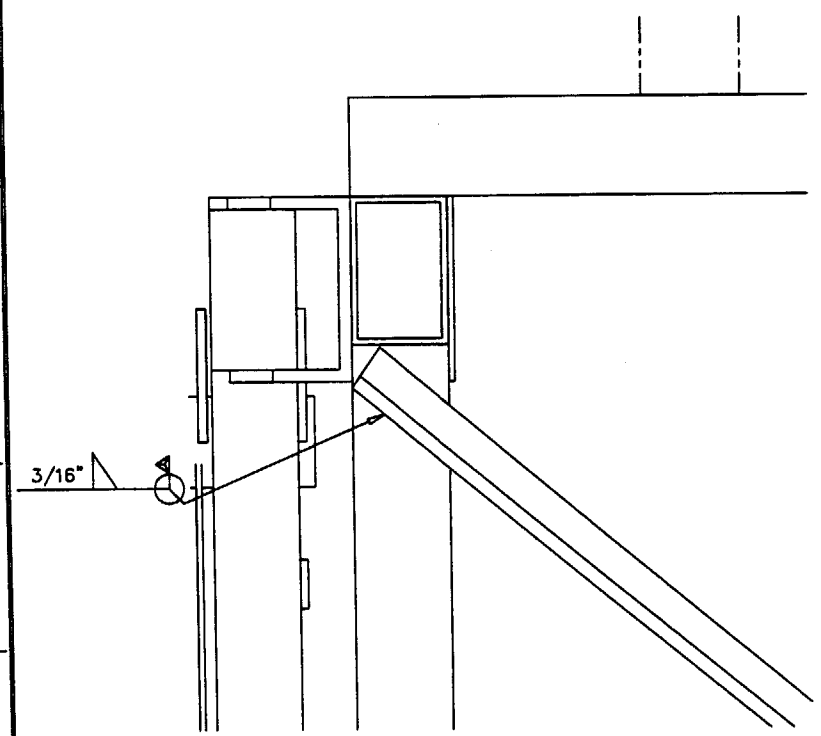
DETAIL 1 / M-11
BEAM-COLUMN CONNECTION
1:4



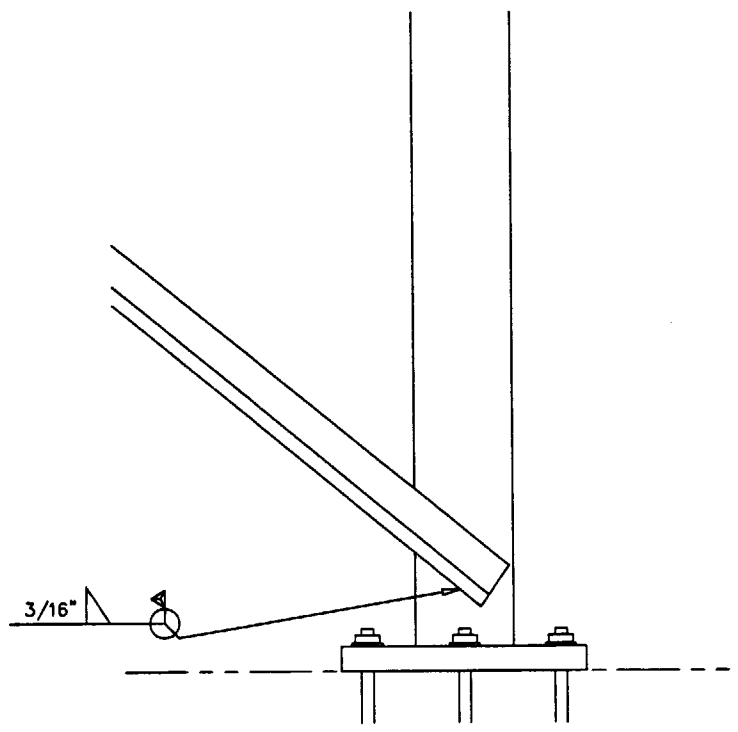
DETAIL 2 / M-11
BASE PLATE
1:4



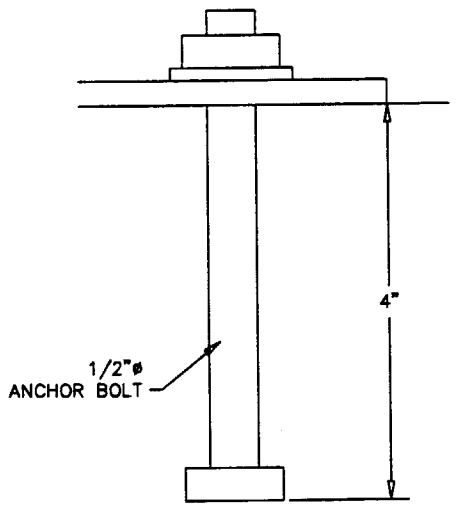
SECTION A / M-11
BASE PLATE
1:2



DETAIL 3 / M-11
CROSS BRACE
@TOP OF FRAME
1:4



DETAIL 4 / M-11
CROSS BRACE
@BASEPLATE
(TYP. ALL CROSS BRACES)
1:4



DETAIL 5 / –
ANCHOR BOLT (TYP.)
1:1

REV	DATE	DESCRIPTION	DESIGN	APP'D BY

NOTES

SCALE:

OU 1-10 TSF-26 WASTE BOX FRAME DETAILS

intrepid technology & resources incorporated
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(208)529-5337 FAX: (208)529-1014

M-12

DRAWN:		TASK ORDER NUMBER	2000-096
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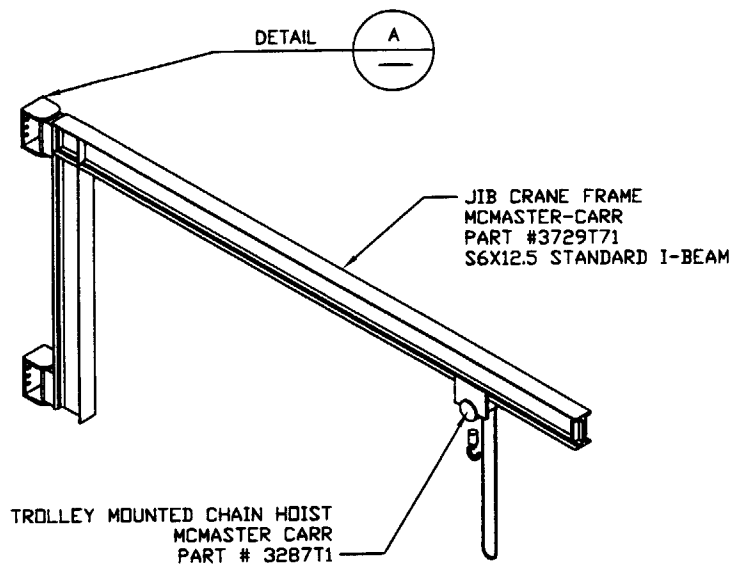
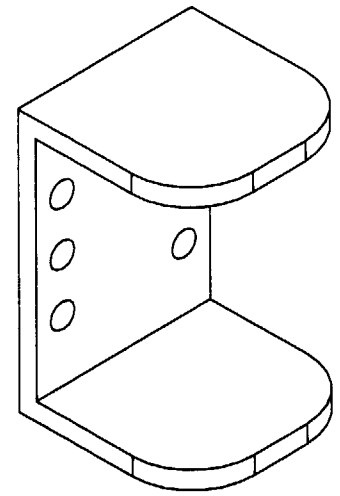
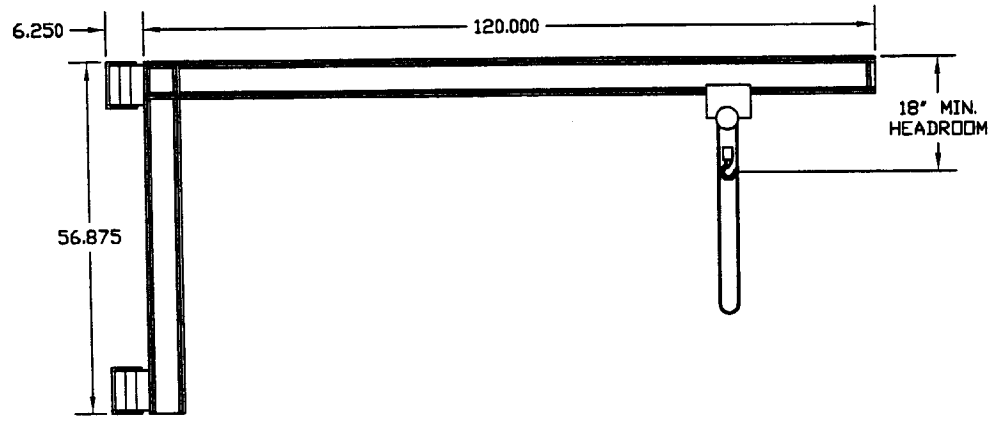
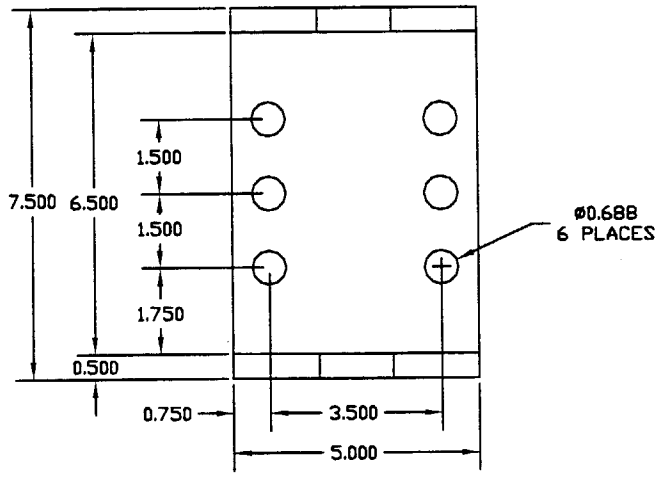
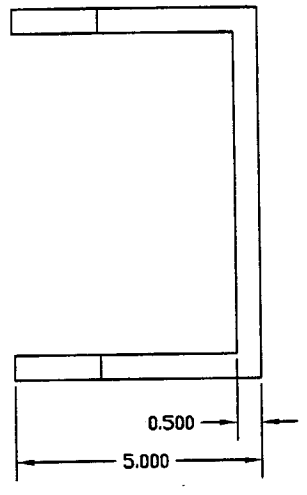






SCALE 1:16





DETAIL A

JIB CRANE MOUNTING BRACKET
1:2
NOTE 2

REV	DATE	DESCRIPTION	DESIGN	APP'D BY

NOTES

1) SEE DRAWING M-11 FOR MOUNTING LOCATION.

2) MOUNTING:
- DRILL $\frac{11}{16}$" HOLES IN MOUNTING STRUCTURE TO ACCOMODATE MOUNTING BRACKET.
- USE ONLY ASTM A325 BOLTS FOR MOUNTING.
- BOLTS SHOULD USE SPLIT RING LOCK WASHERS AND BE TIGHTENED UNTIL THE LOCK WASHER IS COMPLETELY FLATTENED.
- DO NOT OVERTIGHTEN.

SCALE:

OU 1-10 TSF-26 JIB CRANE DETAILS

intrepid technology & resources incorporated
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(208)529-5337 FAX: (208)529-1014

M-19

DRAWN:		TASK ORDER NUMBER 200-096	
DESIGNED:		QA LEVEL: CG	DWG SIZE: D
CHECKED:		DRAWING NUMBER	REV A
APPROVED:			
CADD FILE:*.DWG			

Basic Load Case Data

BLC No.	Basic Load Case Description	Category Code	Category Description	Gravity X	Gravity Y	Gravity Z	Load Type Totals Joint	Point	Direct Dist.	Area	Surf.
1	Dead Load	DL	Dead Load		-1			4	1		
2	Seismic Load X	ELX	Earthquake Load X	.3				4	1		
3	seismic load Z	ELZ	Earthquake Load Z			.3		4	1		
4	jib crane z	OL1	Other Load 1				1	1			
5	jib crane x	OL2	Other Load 2				1	1			

Boundary Conditions

Joint Label	X Translation (k/in)	Y Translation (k/in)	Z Translation (k/in)	MX Rotation (k-ft/rad)	MY Rotation (k-ft/rad)	MZ Rotation (k-ft/rad)
N5	Reaction	Reaction	Reaction			
N6						
N7						
N8	Reaction	Reaction	Reaction			
N5A	Reaction	Reaction	Reaction			
N6A						
N7A						
N8A	Reaction	Reaction	Reaction			

Sections

Section Label	Database Shape	Material Label	Area (in)^2	SA(yy)	SA(zz)	I y-y (in^4)	I z-z (in^4)	J (Torsion) (in^4)	T/C Only
XBRACE	L2X2X4	STL	.938	1.2	1.2	.348	.348	.02	
COL	HSS6X4X3	STL	3.288	1.2	1.2	8.773	16.395	18.279	
SHRTTOPBRACE	HSS4X4X2	STL	1.771	1.2	1.2	4.408	4.408	6.92	
BAYTOP	HSS6X4X3	STL	3.288	1.2	1.2	8.773	16.395	18.279	
LOADCROSS	HSS4X4X2	STL	1.771	1.2	1.2	4.408	4.408	6.92	
S6	HSS4X4X3	STL	2.59	1.2	1.2	6.219	6.219	9.978	

Material Takeoff

Material	Shape	Length (ft)	Weight (k)
STL	HSS4X4X2	12	.072
	L2X2X4	33.941	.108
	HSS6X4X3	40	.447
STL	Totals:	85.941	.628

Load Combinations

Num	Description	Env	WS	PD	SRSS	CD	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	ASCE 1	y				1	DL	1.4						
2	ASCE 5 (a)					1	DL	1.2	ELZ	1	LL	.5	LLS	1
							SL	.2						
3	ASCE 5 (b)					1	DL	1.2	ELX	1	LL	.5	LLS	1
							SL	.2						
4	ASCE 6 (c)					1	DL	.9	ELZ	1				
5	ASCE 6 (d)					1	DL	.9	ELX	1				
6	asce 5 (a) jib z	y				1	L2	1	4	1				
7	asce 5 (b) jib x	y				1	L3	1			5	1		
8	asce 5 (a) jib x	y				1	L2	1			5	1		

Load Combinations (continued)

Num	Description	Env	WS	PD	SRSS	CD	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
9	asce 5 (b) jib z	y				1	L3	1	4	1				

Envelope Member Section Forces

Member Label	Section		Axial (k)	Lc	Shear y-y (k)	Lc	Shear z-z (k)	Lc	Torque (k-ft)	Lc	Moment y-y (k-ft)	Lc	Moment z-z (k-ft)	Lc
M4	1	max	3.17	8	.398	9	-.181	9	0	1	0	1	0	1
		min	1.103	9	-.644	8	-.223	1	0	1	0	1	0	1
	2	max	3.156	8	.395	9	-.181	9	0	1	-.181	9	.644	8
		min	1.089	9	-.644	8	-.223	1	0	1	-.223	1	-.397	9
	3	max	3.143	8	.392	9	-.181	9	0	1	-.361	9	1.287	8
		min	1.076	9	-.644	8	-.223	1	0	1	-.446	1	-.79	9
	4	max	3.13	8	.388	9	-.181	9	0	1	-.542	9	1.931	8
		min	1.062	9	-.644	8	-.223	1	0	1	-.67	1	-1.18	9
	5	max	3.116	8	.385	9	-.181	9	0	1	-.723	9	2.574	8
		min	1.049	9	-.644	8	-.223	1	0	1	-.893	1	-1.566	9
	6	max	3.103	8	.382	9	-.181	9	0	1	-.903	9	3.218	8
		min	1.036	9	-.644	8	-.223	1	0	1	-1.116	1	-1.95	9
	7	max	3.089	8	.378	9	-.181	9	0	1	-1.084	9	3.861	8
		min	1.022	9	-.644	8	-.223	1	0	1	-1.339	1	-2.329	9
M5	1	max	.648	8	3.013	8	.486	7	1.339	1	0	8	3.862	8
		min	-.374	9	1.465	9	-.482	6	1.084	9	0	9	-2.33	9
	2	max	.859	7	.702	8	.271	7	0	1	.134	1	.625	8
		min	.111	6	-.868	9	0	1	-.12	9	-.608	7	-3.406	9
	3	max	.864	7	.684	8	.271	7	0	1	.134	1	-.299	8
		min	.111	6	-.886	9	0	1	-.12	9	-.356	8	-2.237	9
	4	max	.868	7	.666	8	.271	7	0	1	.173	9	-1.045	9
		min	.111	6	-.904	9	0	1	-.12	9	-.146	8	-1.203	1
	5	max	.873	7	.648	8	.271	7	0	1	.475	7	.172	9
		min	.111	6	-.922	9	0	1	-.12	9	-.043	6	-2.074	8
	6	max	.877	7	.63	8	.271	7	0	1	.837	7	1.413	9
		min	.111	6	-.939	9	0	1	-.12	9	.007	6	-2.926	8
	7	max	1.7	7	-1.666	8	.632	8	-1.14	7	0	9	5.145	9
		min	.231	6	-3.322	9	-.251	9	-1.565	6	0	1	-1.443	8
M6	1	max	4.234	9	1.729	7	1.08	9	0	1	0	1	0	1
		min	2.196	8	.232	6	-.223	1	0	1	0	1	0	1
	2	max	4.22	9	1.726	7	1.08	9	0	1	1.08	9	-.232	6
		min	2.183	8	.232	6	-.223	1	0	1	-.223	1	-1.727	7
	3	max	4.207	9	.861	9	-.19	7	0	1	.897	9	-.464	6
		min	2.169	8	-.591	8	-.615	6	0	1	-.446	1	-2.188	7
	4	max	4.193	9	.857	9	-.19	7	0	1	.293	9	-.332	8
		min	2.156	8	-.591	8	-.612	6	0	1	-.67	1	-2.587	9
	5	max	4.18	9	.854	9	-.19	7	0	1	-.312	9	.26	8
		min	2.142	8	-.591	8	-.609	6	0	1	-.893	1	-3.443	9
	6	max	4.167	9	.851	9	-.19	7	0	1	-.916	9	.851	8
		min	2.129	8	-.591	8	-.605	6	0	1	-1.116	1	-4.295	9
	7	max	4.153	9	.847	9	-.187	8	0	1	-1.14	7	1.443	8
		min	2.116	8	-.591	8	-.605	9	0	1	-1.565	6	-5.144	9
M4A	1	max	2.721	1	.403	9	.204	1	0	1	0	1	0	1
		min	1.324	9	-.479	8	.153	6	0	1	0	1	0	1
	2	max	2.705	1	.4	9	.204	1	0	1	.204	1	.479	8
		min	1.311	9	-.479	8	.156	6	0	1	.155	6	-.402	9
	3	max	2.69	1	.397	9	.204	1	0	1	.408	1	.958	8
		min	1.297	9	-.479	8	.16	6	0	1	.312	6	-.8	9
	4	max	2.674	1	.393	9	.204	1	0	1	.612	1	1.437	8
		min	1.284	9	-.479	8	.163	6	0	1	.474	6	-1.195	9
	5	max	2.658	1	.39	9	.204	1	0	1	.816	1	1.915	8
		min	1.27	9	-.479	8	.166	6	0	1	.638	6	-1.587	9

Envelope Member Section Forces, (continued)

Member Label	Section		Axial (k)	Lc	Shear y-y (k)	Lc	Shear z-z (k)	Lc	Torque (k-ft)	Lc	Moment y-y (k-ft)	Lc	Moment z-z (k-ft)	Lc
	6	max	2.643	1	.387	9	.204	1	0	1	1.02	1	2.394	8
		min	1.257	9	-.479	8	.17	6	0	1	.806	6	-1.975	9
	7	max	2.627	1	.383	9	.204	1	0	1	1.224	1	2.873	8
		min	1.244	9	-.479	8	.17	9	0	1	.978	6	-2.36	9
M5A	1	max	.475	8	3.024	1	-.116	7	-.978	6	0	9	2.873	8
		min	-.38	9	1.638	9	-.76	6	-1.224	1	0	8	-2.361	9
	2	max	.378	8	.37	8	.162	8	.026	9	.116	9	-.186	8
		min	.241	9	-.909	9	-.108	9	-.017	8	-.819	8	-3.58	9
	3	max	.378	8	.353	8	.167	8	.026	9	-.028	9	-.668	8
		min	.246	9	-.927	9	-.108	9	-.017	8	-.6	8	-2.356	9
	4	max	.378	8	.335	8	.171	8	.026	9	-.113	7	-1.105	6
		min	.25	9	-.945	9	-.108	9	-.017	8	-.433	6	-1.309	1
	5	max	.378	8	.317	8	.176	8	.026	9	.019	7	.163	9
		min	.255	9	-.963	9	-.108	9	-.017	8	-.478	6	-1.561	8
	6	max	.378	8	.299	8	.18	8	.026	9	.151	7	1.459	9
		min	.259	9	-.981	9	-.108	9	-.017	8	-.516	6	-1.971	8
	7	max	.879	9	-2.284	8	.997	6	1.224	1	0	8	5.356	9
		min	.033	8	-3.477	9	.201	1	.909	6	0	9	.174	8
M6A	1	max	3.118	9	.903	9	.204	1	0	1	0	1	0	1
		min	1.251	8	.029	8	.141	6	0	1	0	1	0	1
	2	max	3.104	9	.899	9	.204	1	0	1	.204	1	-.029	8
		min	1.237	8	.029	8	.145	6	0	1	.143	6	-.901	9
	3	max	3.091	9	.896	9	.204	1	0	1	.408	1	-.058	8
		min	1.224	8	.029	8	.148	6	0	1	.29	6	-1.799	9
	4	max	3.077	9	.893	9	.204	1	0	1	.612	1	-.087	8
		min	1.21	8	.029	8	.152	6	0	1	.44	6	-2.693	9
	5	max	3.064	9	.889	9	.204	1	0	1	.816	1	-.116	8
		min	1.197	8	.029	8	.155	6	0	1	.593	6	-3.584	9
	6	max	3.05	9	.886	9	.204	1	0	1	1.02	1	-.145	8
		min	1.183	8	.029	8	.158	6	0	1	.749	6	-4.471	9
	7	max	3.037	9	.883	9	.204	1	0	1	1.224	1	-.174	8
		min	1.17	8	.029	8	.162	6	0	1	.909	6	-5.356	9
M8	1	max	1.317	6	.006	9	.004	9	0	9	0	1	0	1
		min	.406	7	0	8	-.004	8	0	8	0	1	0	1
	2	max	1.322	6	.002	9	.002	9	0	9	.007	9	0	9
		min	.41	7	-.002	8	-.004	8	0	8	-.005	8	-.004	8
	3	max	1.326	6	-.002	9	.001	9	0	9	.009	9	0	9
		min	.414	7	-.005	8	-.004	8	0	8	-.012	8	-.004	8
	4	max	1.349	6	.008	7	.004	8	0	9	.006	9	.005	1
		min	.44	7	-.008	1	-.004	7	0	8	-.023	8	-.002	8
	5	max	1.354	6	.005	8	.004	8	0	1	.009	9	0	9
		min	.444	7	.002	9	-.001	9	0	1	-.012	8	-.005	8
	6	max	1.359	6	.002	8	.004	8	0	1	.007	9	0	9
		min	.447	7	-.002	9	-.002	9	0	1	-.005	8	-.004	8
	7	max	1.363	6	0	8	.004	8	0	1	0	1	0	1
		min	.451	7	-.006	9	-.004	9	0	1	0	1	0	1
M9	1	max	.955	7	.005	6	0	1	0	8	0	1	0	1
		min	-.432	6	0	7	-.008	7	0	9	0	1	0	1
	2	max	.959	7	0	1	0	1	0	8	.003	1	-.003	1
		min	-.429	6	-.003	7	-.007	7	0	9	-.009	7	-.006	7
	3	max	.963	7	-.004	1	0	1	0	8	.002	1	-.001	6
		min	-.426	6	-.007	7	-.006	7	0	9	-.021	7	-.008	7
	4	max	.982	7	.011	7	0	9	0	8	-.004	1	.005	6
		min	-.423	6	-.011	8	-.004	7	0	9	-.035	7	-.003	7
	5	max	.986	7	.007	7	.006	7	0	1	.002	1	-.001	1
		min	-.409	6	.004	1	0	1	0	1	-.021	7	-.007	7
	6	max	.99	7	.003	7	.007	7	0	1	.003	1	-.003	1
		min	-.407	6	0	1	0	1	0	1	-.009	7	-.006	7

Envelope Member Section Forces, (continued)

Member Label	Section		Axial (k)	Lc	Shear y-y (k)	Lc	Shear z-z (k)	Lc	Torque (k-ft)	Lc	Moment y-y (k-ft)	Lc	Moment z-z (k-ft)	Lc
	7	max	.994	7	0	7	.008	7	0	1	0	1	0	1
		min	-.404	6	-.005	6	0	1	0	1	0	1	0	1
M10	1	max	1.635	6	.005	1	.003	9	0	9	0	1	0	1
		min	.567	1	0	8	-.004	8	0	8	0	1	0	1
	2	max	1.64	6	0	1	.002	9	0	9	.005	9	0	9
		min	.571	1	-.002	8	-.004	8	0	8	-.005	8	-.004	8
	3	max	1.645	6	-.003	9	0	9	0	9	.005	9	.002	9
		min	.576	1	-.005	8	-.004	8	0	8	-.012	8	-.005	8
	4	max	1.669	6	-.006	6	0	1	0	9	0	9	.007	9
		min	.597	1	-.009	7	-.005	7	0	8	-.023	8	-.002	8
	5	max	1.674	6	.005	8	.004	8	0	1	.007	9	0	9
		min	.601	1	.002	9	0	9	0	1	-.012	8	-.004	8
	6	max	1.678	6	.002	8	.004	8	0	1	.006	9	0	9
		min	.606	1	-.001	9	-.002	9	0	1	-.005	8	-.004	8
	7	max	1.683	6	-.001	8	.004	8	0	1	0	1	0	1
		min	.61	1	-.005	1	-.003	9	0	1	0	1	0	1
M11	1	max	.594	1	.005	1	0	1	0	1	0	1	0	1
		min	-1.871	6	0	7	-.009	7	0	9	0	1	0	1
	2	max	.598	1	0	1	0	1	0	1	.003	1	-.003	6
		min	-1.868	6	-.004	7	-.007	7	0	9	-.01	7	-.006	7
	3	max	.603	1	-.004	1	0	1	0	1	.002	1	0	6
		min	-1.865	6	-.008	7	-.006	7	0	9	-.022	7	-.007	7
	4	max	.624	1	-.008	1	.005	7	0	1	-.004	1	.007	6
		min	-1.862	6	-.012	7	-.004	8	0	9	-.038	7	-.003	7
	5	max	.628	1	.007	7	.006	7	0	1	.002	1	-.001	6
		min	-1.848	6	.004	1	0	1	0	1	-.022	7	-.008	7
	6	max	.633	1	.004	7	.007	7	0	1	.003	1	-.003	1
		min	-1.845	6	0	1	0	1	0	1	-.01	7	-.006	7
	7	max	.637	1	0	7	.009	7	0	1	0	1	0	1
		min	-1.842	6	-.005	1	0	1	0	1	0	1	0	1
M13	1	max	.5	6	2.689	1	.127	6	-.005	6	1.185	7	1.372	1
		min	-.215	7	2.293	8	-.818	7	-.014	7	-.315	6	1.143	8
	2	max	-.102	6	-.093	9	.127	6	-.005	6	.367	7	-1.086	9
		min	-.215	7	-.119	1	-.217	7	-.014	7	-.188	6	-1.312	1
	3	max	-.104	6	-.1	9	.127	6	-.005	6	.157	8	-.99	9
		min	-.215	7	-.128	1	-.215	7	-.014	7	-.067	9	-1.189	1
	4	max	-.106	6	-.107	9	.127	6	-.005	6	.067	1	-.884	6
		min	-.215	7	-.136	1	-.213	7	-.014	7	-.063	7	-1.057	1
	5	max	-.108	6	-.114	9	.127	6	-.005	6	.193	6	-.757	6
		min	-.215	7	-.145	1	-.211	7	-.014	7	-.275	7	-.917	1
	6	max	-.109	6	-.122	9	.127	6	-.005	6	.32	6	-.622	6
		min	-.215	7	-.153	1	-.209	7	-.014	7	-.485	7	-.768	1
	7	max	-.124	9	-2.529	9	.616	9	-.005	6	.448	6	1.257	1
		min	-.802	8	-2.961	1	-.097	8	-.014	7	-.294	7	1.062	7
M14	1	max	.459	8	2.689	1	0	1	.009	1	1.071	7	1.466	9
		min	-.393	9	2.278	8	-.819	7	-.024	7	-.066	1	1.095	8
	2	max	-.126	7	-.043	9	.007	9	.009	1	.635	8	-.895	9
		min	-.41	6	-.129	8	-.345	8	-.024	7	-.248	9	-1.312	1
	3	max	-.126	7	-.05	9	.009	9	.009	1	.29	8	-.848	9
		min	-.412	6	-.136	8	-.345	8	-.024	7	-.24	9	-1.189	1
	4	max	-.126	7	-.057	9	.011	9	.009	1	-.054	8	-.795	9
		min	-.413	6	-.143	8	-.345	8	-.024	7	-.23	9	-1.057	1
	5	max	-.126	7	-.064	9	.012	9	.009	1	-.067	1	-.72	6
		min	-.415	6	-.151	8	-.345	8	-.024	7	-.399	8	-.917	1
	6	max	-.126	7	-.072	9	.014	9	.009	1	-.068	1	-.606	8
		min	-.417	6	-.158	8	-.345	8	-.024	7	-.744	8	-.768	1
	7	max	-.126	7	-2.479	9	.616	9	.009	1	.21	9	1.257	1
		min	-1.019	6	-2.962	1	-.345	8	-.024	7	-1.089	8	1.01	9

Envelope Member Stresses

Member Label	Section		Axial (ksi)	Lc	Shear y-y (ksi)	Lc	Shear z-z (ksi)	Lc	Bending y-top (ksi)	Lc	Bending y-bot (ksi)	Lc	Bending z-top (ksi)	Lc	Bending z-bot (ksi)	Lc
M4	1	max	.964	8	.228	9	-.155	9	0	1	0	1	0	1	0	1
		min	.335	9	-.369	8	-.192	1	0	1	0	1	0	1	0	1
	2	max	.96	8	.226	9	-.155	9	.871	9	1.413	8	-.494	9	.611	1
		min	.331	9	-.369	8	-.192	1	-1.413	8	-.871	9	-.611	1	.494	9
	3	max	.956	8	.225	9	-.155	9	1.734	9	2.826	8	-.988	9	1.221	1
		min	.327	9	-.369	8	-.192	1	-2.826	8	-1.734	9	-1.221	1	.988	9
	4	max	.952	8	.223	9	-.155	9	2.591	9	4.239	8	-1.482	9	1.832	1
		min	.323	9	-.369	8	-.192	1	-4.239	8	-2.591	9	-1.832	1	1.482	9
	5	max	.948	8	.221	9	-.155	9	3.439	9	5.652	8	-1.977	9	2.442	1
		min	.319	9	-.369	8	-.192	1	-5.652	8	-3.439	9	-2.442	1	1.977	9
	6	max	.944	8	.219	9	-.155	9	4.281	9	7.066	8	-2.471	9	3.053	1
		min	.315	9	-.369	8	-.192	1	-7.066	8	-4.281	9	-3.053	1	2.471	9
	7	max	.94	8	.217	9	-.155	9	5.115	9	8.479	8	-2.965	9	3.663	1
		min	.311	9	-.369	8	-.192	1	-8.479	8	-5.115	9	-3.663	1	2.965	9
M5	1	max	.197	8	1.728	8	.418	7	5.115	9	8.479	8	0	8	0	9
		min	-.114	9	.84	9	-.415	6	-8.479	8	-5.115	9	0	9	0	8
	2	max	.261	7	.402	8	.233	7	7.48	9	1.372	8	.367	1	1.664	7
		min	.034	6	-.498	9	0	1	-1.372	8	-7.48	9	-1.664	7	-.367	1
	3	max	.263	7	.392	8	.233	7	4.913	9	-.656	8	.368	1	.975	8
		min	.034	6	-.508	9	0	1	.656	8	-4.913	9	-.975	8	-.368	1
	4	max	.264	7	.382	8	.233	7	2.642	1	-2.294	9	.473	9	.399	8
		min	.034	6	-.518	9	0	1	2.294	9	-2.642	1	-.399	8	-.473	9
	5	max	.265	7	.372	8	.233	7	4.554	8	.378	9	1.301	7	.118	6
		min	.034	6	-.528	9	0	1	-.378	9	-4.554	8	-.118	6	-1.301	7
	6	max	.267	7	.361	8	.233	7	6.425	8	3.102	9	2.289	7	-.019	6
		min	.034	6	-.539	9	0	1	-3.102	9	-6.425	8	.019	6	-2.289	7
	7	max	.517	7	-.955	8	.544	8	3.167	8	11.297	9	.001	9	0	1
		min	.07	6	-1.905	9	-.216	9	-11.297	9	-3.167	8	0	1	-.001	9
M6	1	max	1.288	9	.992	7	.929	9	0	1	0	1	0	1	0	1
		min	.668	8	.133	6	-.192	1	0	1	0	1	0	1	0	1
	2	max	1.284	9	.99	7	.929	9	3.793	7	-.509	6	2.956	9	.611	1
		min	.664	8	.133	6	-.192	1	.509	6	-3.793	7	-.611	1	-2.956	9
	3	max	1.28	9	.494	9	-.163	7	4.804	7	-1.018	6	2.454	9	1.221	1
		min	.66	8	-.339	8	-.529	6	1.018	6	-4.804	7	-1.221	1	-2.454	9
	4	max	1.276	9	.492	9	-.163	7	5.681	9	-.728	8	.801	9	1.832	1
		min	.656	8	-.339	8	-.526	6	.728	8	-5.681	9	-1.832	1	-.801	9
	5	max	1.271	9	.49	9	-.163	7	7.56	9	.57	8	-.853	9	2.442	1
		min	.652	8	-.339	8	-.523	6	-.57	8	-7.56	9	-2.442	1	.853	9
	6	max	1.267	9	.488	9	-.163	7	9.431	9	1.869	8	-2.507	9	3.053	1
		min	.648	8	-.339	8	-.521	6	-1.869	8	-9.431	9	-3.053	1	2.507	9
	7	max	1.263	9	.486	9	-.161	8	11.296	9	3.168	8	-3.118	7	4.282	6
		min	.643	8	-.339	8	-.52	9	-3.168	8	-11.296	9	-4.282	6	3.118	7
M4A	1	max	.828	1	.231	9	.175	1	0	1	0	1	0	1	0	1
		min	.403	9	-.275	8	.132	6	0	1	0	1	0	1	0	1
	2	max	.823	1	.229	9	.175	1	.882	9	1.051	8	.558	1	-.423	6
		min	.399	9	-.275	8	.134	6	-1.051	8	-.882	9	.423	6	-.558	1
	3	max	.818	1	.228	9	.175	1	1.757	9	2.103	8	1.116	1	-.855	6
		min	.395	9	-.275	8	.137	6	-2.103	8	-1.757	9	.855	6	-1.116	1
	4	max	.813	1	.226	9	.175	1	2.625	9	3.154	8	1.674	1	-1.296	6
		min	.391	9	-.275	8	.14	6	-3.154	8	-2.625	9	1.296	6	-1.674	1
	5	max	.809	1	.224	9	.175	1	3.485	9	4.206	8	2.232	1	-1.746	6
		min	.386	9	-.275	8	.143	6	-4.206	8	-3.485	9	1.746	6	-2.232	1
	6	max	.804	1	.222	9	.175	1	4.338	9	5.257	8	2.79	1	-2.206	6
		min	.382	9	-.275	8	.146	6	-5.257	8	-4.338	9	2.206	6	-2.79	1
	7	max	.799	1	.22	9	.175	1	5.183	9	6.309	8	3.348	1	-2.675	6
		min	.378	9	-.275	8	.147	9	-6.309	8	-5.183	9	2.675	6	-3.348	1
M5A	1	max	.144	8	1.734	1	-.1	7	5.184	9	6.309	8	0	9	0	8

Envelope Member Stresses, (continued)

Member Label	Section		Axial (ksi)	Lc	Shear y-y (ksi)	Lc	Shear z-z (ksi)	Lc	Bending y-top (ksi)	Lc	Bending y-bot (ksi)	Lc	Bending z-top (ksi)	Lc	Bending z-bot (ksi)	Lc
		min	-.115	9	.939	9	-.654	6	-6.309	8	-5.184	9	0	8	0	9
	2	max	.115	8	.212	8	.14	8	7.861	9	-.409	8	.317	9	2.24	8
		min	.073	9	-.521	9	-.093	9	.409	8	-7.861	9	-2.24	8	-.317	9
	3	max	.115	8	.202	8	.143	8	5.174	9	-1.467	8	-.076	9	1.641	8
		min	.075	9	-.532	9	-.093	9	1.467	8	-5.174	9	-1.641	8	.076	9
	4	max	.115	8	.192	8	.147	8	2.874	1	-2.427	6	-.31	7	1.185	6
		min	.076	9	-.542	9	-.093	9	2.427	6	-2.874	1	-1.185	6	.31	7
	5	max	.115	8	.182	8	.151	8	3.427	8	.359	9	.051	7	1.306	6
		min	.077	9	-.552	9	-.093	9	-.359	9	-3.427	8	-1.306	6	-.051	7
	6	max	.115	8	.171	8	.155	8	4.328	8	3.204	9	.412	7	1.412	6
		min	.079	9	-.562	9	-.093	9	-3.204	9	-4.328	8	-1.412	6	-.412	7
	7	max	.268	9	-1.31	8	.857	6	-.382	8	11.761	9	0	8	.001	9
		min	.01	8	-1.994	9	.173	1	-11.761	9	.382	8	-.001	9	0	8
M6A	1	max	.948	9	.518	9	.175	1	0	1	0	1	0	1	0	1
		min	.38	8	.017	8	.122	6	0	1	0	1	0	1	0	1
	2	max	.944	9	.516	9	.175	1	1.978	9	-.064	8	.558	1	-.392	6
		min	.376	8	.017	8	.125	6	.064	8	-1.978	9	.392	6	-.558	1
	3	max	.94	9	.514	9	.175	1	3.949	9	-.128	8	1.116	1	-.792	6
		min	.372	8	.017	8	.127	6	.128	8	-3.949	9	.792	6	-1.116	1
	4	max	.936	9	.512	9	.175	1	5.913	9	-.191	8	1.674	1	-1.202	6
		min	.368	8	.017	8	.13	6	.191	8	-5.913	9	1.202	6	-1.674	1
	5	max	.932	9	.51	9	.175	1	7.869	9	-.255	8	2.232	1	-1.621	6
		min	.364	8	.017	8	.133	6	.255	8	-7.869	9	1.621	6	-2.232	1
	6	max	.928	9	.508	9	.175	1	9.818	9	-.319	8	2.79	1	-2.05	6
		min	.36	8	.017	8	.136	6	.319	8	-9.818	9	2.05	6	-2.79	1
	7	max	.924	9	.506	9	.175	1	11.76	9	-.383	8	3.348	1	-2.487	6
		min	.356	8	.017	8	.139	6	.383	8	-11.76	9	2.487	6	-3.348	1
M8	1	max	1.404	6	.014	9	.009	9	0	1	0	1	0	1	0	1
		min	.433	7	.002	8	-.01	8	0	1	0	1	0	1	0	1
	2	max	1.409	6	.005	9	.006	9	.102	8	-.029	9	.394	9	.327	8
		min	.437	7	-.005	8	-.01	8	.029	9	-.102	8	-.26	8	-.496	9
	3	max	1.414	6	-.004	9	.002	9	.121	8	.014	9	.5	9	.855	8
		min	.441	7	-.012	8	-.01	8	-.014	9	-.121	8	-.68	8	-.628	9
	4	max	1.438	6	.019	7	.01	8	.067	8	.143	1	.333	9	1.608	8
		min	.469	7	-.02	1	-.011	7	-.143	1	-.067	8	-1.279	8	-.418	9
	5	max	1.443	6	.011	8	.01	8	.134	8	.029	9	.493	9	.855	8
		min	.473	7	.004	9	-.003	9	-.029	9	-.134	8	-.68	8	-.62	9
	6	max	1.448	6	.005	8	.01	8	.108	8	-.021	9	.391	9	.327	8
		min	.477	7	-.005	9	-.006	9	.021	9	-.108	8	-.26	8	-.491	9
	7	max	1.454	6	-.002	8	.01	8	0	1	0	1	0	1	0	1
		min	.481	7	-.014	9	-.009	9	0	1	0	1	0	1	0	1
M9	1	max	1.018	7	.013	6	0	1	0	1	0	1	0	1	0	1
		min	-.46	6	.001	7	-.02	7	0	1	0	1	0	1	0	1
	2	max	1.022	7	.002	1	0	1	.185	7	-.083	1	.172	1	.635	7
		min	-.457	6	-.008	7	-.017	7	.083	1	-.185	7	-.506	7	-.216	1
	3	max	1.026	7	-.009	1	0	1	.221	7	-.037	6	.094	1	1.444	7
		min	-.454	6	-.017	7	-.014	7	.037	6	-.221	7	-1.149	7	-.118	1
	4	max	1.047	7	.026	7	0	9	.098	7	.151	6	-.224	1	2.45	7
		min	-.451	6	-.027	8	-.01	7	-.151	6	-.098	7	-1.95	7	.281	1
	5	max	1.051	7	.017	7	.014	7	.214	7	-.039	1	.107	1	1.459	7
		min	-.437	6	.009	1	0	1	.039	1	-.214	7	-1.161	7	-.135	1
	6	max	1.056	7	.008	7	.017	7	.182	7	-.084	1	.178	1	.643	7
		min	-.433	6	-.002	1	0	1	.084	1	-.182	7	-.511	7	-.224	1
	7	max	1.06	7	-.001	7	.02	7	0	1	0	1	0	1	0	1
		min	-.43	6	-.013	6	0	1	0	1	0	1	0	1	0	1
M10	1	max	1.743	6	.012	1	.007	9	0	1	0	1	0	1	0	1
		min	.604	1	.002	8	-.01	8	0	1	0	1	0	1	0	1
	2	max	1.749	6	.002	1	.004	9	.107	8	-.006	9	.279	9	.325	8

Envelope Member Stresses, (continued)

Member Label	Section		Axial (ksi)	Lc	Shear y-y (ksi)	Lc	Shear z-z (ksi)	Lc	Bending y-top (ksi)	Lc	Bending y-bot (ksi)	Lc	Bending z-top (ksi)	Lc	Bending z-bot (ksi)	Lc
		min	.609	1	-.005	8	-.01	8	.006	9	-.107	8	-.259	8	-.35	9
	3	max	1.754	6	-.008	9	0	9	.13	8	.059	9	.269	9	.851	8
		min	.614	1	-.011	8	-.01	8	-.059	9	-.13	8	-.677	8	-.338	9
	4	max	1.779	6	-.014	6	0	1	.071	8	.21	9	-.003	9	1.579	8
		min	.636	1	-.021	7	-.011	7	-.21	9	-.071	8	-1.256	8	.004	9
	5	max	1.784	6	.011	8	.01	8	.129	8	.027	9	.368	9	.838	8
		min	.641	1	.006	9	-.001	9	-.027	9	-.129	8	-.667	8	-.462	9
	6	max	1.789	6	.004	8	.01	8	.106	8	-.022	9	.328	9	.319	8
		min	.646	1	-.003	9	-.005	9	.022	9	-.106	8	-.253	8	-.412	9
	7	max	1.794	6	-.002	8	.01	8	0	1	0	1	0	1	0	1
		min	.65	1	-.013	1	-.008	9	0	1	0	1	0	1	0	1
M11	1	max	.633	1	.013	1	0	1	0	1	0	1	0	1	0	1
		min	-1.994	6	0	7	-.021	7	0	1	0	1	0	1	0	1
	2	max	.638	1	.002	1	0	1	.174	7	-.074	6	.175	1	.699	7
		min	-1.991	6	-.009	7	-.018	7	.074	6	-.174	7	-.557	7	-.219	1
	3	max	.643	1	-.009	1	0	1	.198	7	-.01	6	.1	1	1.572	7
		min	-1.988	6	-.019	7	-.014	7	.01	6	-.198	7	-1.251	7	-.126	1
	4	max	.665	1	-.02	1	.011	7	.079	7	.192	6	-.223	1	2.634	7
		min	-1.985	6	-.028	7	-.01	8	-.192	6	-.079	7	-2.096	7	.281	1
	5	max	.67	1	.018	7	.015	7	.218	7	-.037	6	.102	1	1.545	7
		min	-1.97	6	.009	1	0	1	.037	6	-.218	7	-1.229	7	-.128	1
	6	max	.674	1	.009	7	.018	7	.183	7	-.085	1	.175	1	.686	7
		min	-1.967	6	-.002	1	0	1	.085	1	-.183	7	-.546	7	-.221	1
	7	max	.679	1	0	7	.021	7	0	1	0	1	0	1	0	1
		min	-1.964	6	-.013	1	0	1	0	1	0	1	0	1	0	1
M13	1	max	.282	6	3.47	1	.164	6	-6.221	8	7.473	1	6.449	7	1.717	6
		min	-.122	7	2.959	8	-1.056	7	-7.473	1	6.221	8	-1.717	6	-6.449	7
	2	max	-.058	6	-.12	9	.164	6	7.146	1	-5.914	9	1.998	7	1.025	6
		min	-.122	7	-.154	1	-.28	7	5.914	9	-7.146	1	-1.025	6	-1.998	7
	3	max	-.059	6	-.129	9	.164	6	6.473	1	-5.389	9	.857	8	.366	9
		min	-.122	7	-.165	1	-.277	7	5.389	9	-6.473	1	-.366	9	-.857	8
	4	max	-.06	6	-.138	9	.164	6	5.755	1	-4.815	6	.365	1	.342	7
		min	-.122	7	-.176	1	-.275	7	4.815	6	-5.755	1	-.342	7	-.365	1
	5	max	-.061	6	-.148	9	.164	6	4.99	1	-4.122	6	1.052	6	1.497	7
		min	-.122	7	-.187	1	-.273	7	4.122	6	-4.99	1	-1.497	7	-1.052	6
	6	max	-.062	6	-.157	9	.164	6	4.18	1	-3.389	6	1.744	6	2.642	7
		min	-.122	7	-.197	1	-.27	7	3.389	6	-4.18	1	-2.642	7	-1.744	6
	7	max	-.07	9	-3.263	9	.795	9	-5.784	7	6.845	1	2.437	6	1.599	7
		min	-.453	8	-3.821	1	-.125	8	-6.845	1	5.784	7	-1.599	7	-2.437	6
M14	1	max	.259	8	3.47	1	0	1	-5.961	8	7.983	9	5.833	7	.359	1
		min	-.222	9	2.94	8	-1.057	7	-7.983	9	5.961	8	-.359	1	-5.833	7
	2	max	-.071	7	-.055	9	.009	9	7.146	1	-4.871	9	3.458	8	1.349	9
		min	-.231	6	-.166	8	-.445	8	4.871	9	-7.146	1	-1.349	9	-3.458	8
	3	max	-.071	7	-.064	9	.011	9	6.473	1	-4.619	9	1.581	8	1.306	9
		min	-.232	6	-.176	8	-.445	8	4.619	9	-6.473	1	-1.306	9	-1.581	8
	4	max	-.071	7	-.074	9	.014	9	5.755	1	-4.327	9	-.296	8	1.254	9
		min	-.233	6	-.185	8	-.445	8	4.327	9	-5.755	1	-1.254	9	.296	8
	5	max	-.071	7	-.083	9	.016	9	4.99	1	-3.921	6	-.367	1	2.173	8
		min	-.234	6	-.194	8	-.445	8	3.921	6	-4.99	1	-2.173	8	.367	1
	6	max	-.071	7	-.092	9	.018	9	4.18	1	-3.3	8	-.37	1	4.05	8
		min	-.235	6	-.204	8	-.445	8	3.3	8	-4.18	1	-4.05	8	.37	1
	7	max	-.071	7	-3.199	9	.795	9	-5.5	9	6.845	1	1.141	9	5.927	8
		min	-.575	6	-3.821	1	-.445	8	-6.845	1	5.5	9	-5.927	8	-1.141	9

Member Data

Member Label	I Joint	J Joint	K Joint	X-Axis Rotate (degrees)	Shape / Section Set	Material Set	Phys Memb	TOM	End Releases I-End xyz xyz	End Releases J-End xyz xyz	End Offsets I-End (in)	End Offsets J-End (in)	Inactive Code	Length (ft)
M4	N5	N6			COL	STL	Y		BenPIN					6
M5	N6	N7			BAYTOP	STL	Y							8
M6	N8	N7			COL	STL	Y		BenPIN					6
M4A	N5A	N6A			COL	STL	Y		BenPIN					6
M5A	N6A	N7A			BAYTOP	STL	Y							8
M6A	N8A	N7A			COL	STL	Y		BenPIN					6
M7	N6	N6A			SHRTTO...	STL	Y						Y	6
M8	N6A	N5			XBRACE	STL	Y		BenPIN	BenPIN				8.485
M9	N6	N5A			XBRACE	STL	Y		BenPIN	BenPIN				8.485
M10	N7A	N8			XBRACE	STL	Y		BenPIN	BenPIN				8.485
M11	N7	N8A			XBRACE	STL	Y		BenPIN	BenPIN				8.485
M12	N7	N7A			SHRTTO...	STL	Y						Y	6
M13	N12	N11			LOADCR..	STL	Y	Y						6
M14	N14	N13			LOADCR..	STL	Y	Y						6

Member Point Loads, Category : DL, BLC 1 : Dead Load

Member Label	I Joint	J Joint	Direction	Magnitude (k, k-ft)	Location (ft or %)
M14	N14	N13	Y	-2	1
M14	N14	N13	Y	-2	5.333
M13	N12	N11	Y	-2	5.333
M13	N12	N11	Y	-2	1

Member Point Loads, Category : ELX, BLC 2 : Seismic Load X

Member Label	I Joint	J Joint	Direction	Magnitude (k, k-ft)	Location (ft or %)
M14	N14	N13	X	.6	1
M14	N14	N13	X	.6	5.333
M13	N12	N11	X	.6	5.333
M13	N12	N11	X	.6	1

Member Point Loads, Category : ELZ, BLC 3 : seismic load Z

Member Label	I Joint	J Joint	Direction	Magnitude (k, k-ft)	Location (ft or %)
M14	N14	N13	Z	.6	1
M14	N14	N13	Z	.6	5.333
M13	N12	N11	Z	.6	5.333
M13	N12	N11	Z	.6	1

Member Point Loads, Category : OL1, BLC 4 : jib crane z

Member Label	I Joint	J Joint	Direction	Magnitude (k, k-ft)	Location (ft or %)
M6	N8	N7	Z	-1.685	1.25

Member Point Loads, Category : OL2, BLC 5 : jib crane x

Member Label	I Joint	J Joint	Direction	Magnitude (k, k-ft)	Location (ft or %)
M6	N8	N7	X	1.685	1.25

Joint Loads/Enforced Displacements, Category : OL1, BLC 4 : jib crane z

Joint Label	[L]oad,[M]ass,or [D]isplacement	Direction	Magnitude (k, k-ft, in, rad, k*s^2/ft)
N7	L	Z	1.685

Joint Loads/Enforced Displacements, Category : OL2, BLC 5 : jib crane x

Joint Label	[L]oad,[M]ass,or [D]isplacement	Direction	Magnitude (k, k-ft, in, rad, k*s^2/ft)
N7	L	X	-1.685

Envelope Member AISC ASD 9th Code Checks

Label	Code Chk	Loc (ft)	Lc	Shear Chk	Loc (ft)	Dir	Lc	ASD Eqn.	Message
M4	.538	6	8	.026	0	y	8	H1-2	
M5	.487	8	9	.295	8	y	9	H1-2	
M6	.718	6	9	.069	0	y	7	H1-3	
M4A	.410	6	8	.019	0	y	8	H1-2	
M5A	.507	8	9	.252	8	y	1	H1-2	
M6A	.649	6	9	.036	0	y	9	H1-2	
M8	.660	8.485	6	.006	4.243	y	8	H1-1	- Code check based on z-z Axial..
M9	.481	8.485	7	.007	4.243	y	8	H1-1	- Code check based on z-z Axial..
M10	.815	8.485	6	.008	4.243	y	9	H1-1	- Code check based on z-z Axial..
M11	.308	8.485	1	.009	4.243	y	7	H1-1	- Code check based on z-z Axial..
M13	.550	0	7	.267	6	y	1	H2-1	
M14	.534	6	8	.267	6	y	1	H2-1	

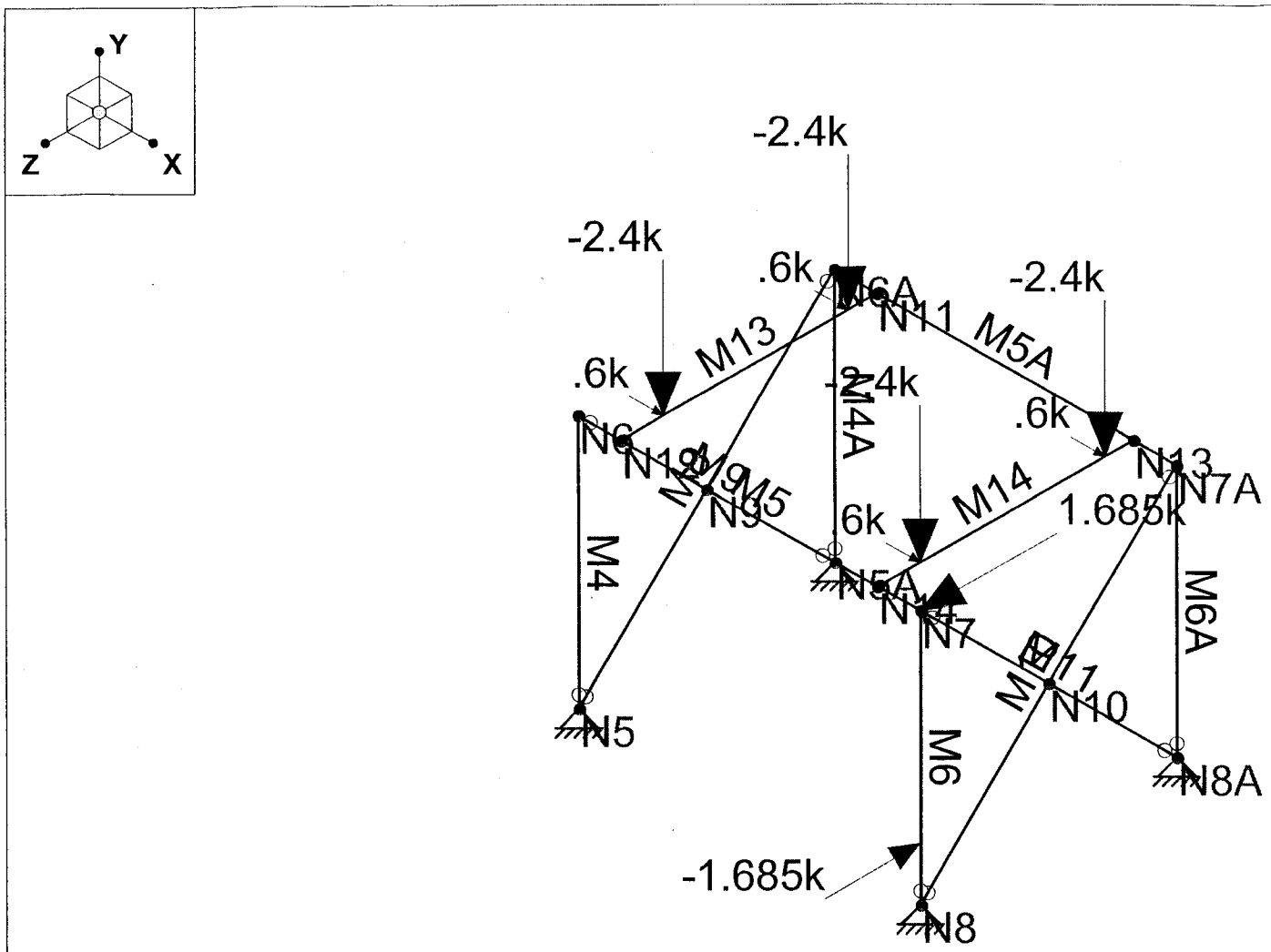
Envelope Reactions

Joint Label		X Force (k)	Lc	Y Force (k)	Lc	Z Force (k)	Lc	X Moment (k-ft)	Lc	Y Moment (k-ft)	Lc	Z Moment (k-ft)	Lc
N5	max	.648	8	4.027	8	-.506	7	0.000	1	0.000	1	0.000	1
	min	-.402	9	1.533	9	-1.163	6	0.000	1	0.000	1	0.000	1
N8	max	-.231	6	4.991	6	.611	9	0.000	1	0.000	1	0.000	1
	min	-1.729	7	2.865	1	-1.358	8	0.000	1	0.000	1	0.000	1
N5A	max	.475	8	3.175	1	.876	7	0.000	1	0.000	1	0.000	1
	min	-.408	9	1.459	6	-.136	6	0.000	1	0.000	1	0.000	1
N8A	max	-.033	8	3.175	1	.651	1	0.000	1	0.000	1	0.000	1
	min	-.908	9	.186	6	-1.164	6	0.000	1	0.000	1	0.000	1
Reaction Totals :	max	0.000	6	12.079	1	0.000	9						
	min	-2.588	7	10.354	7	-2.588	8						

Envelope Member AISC ASD 9th Code Details

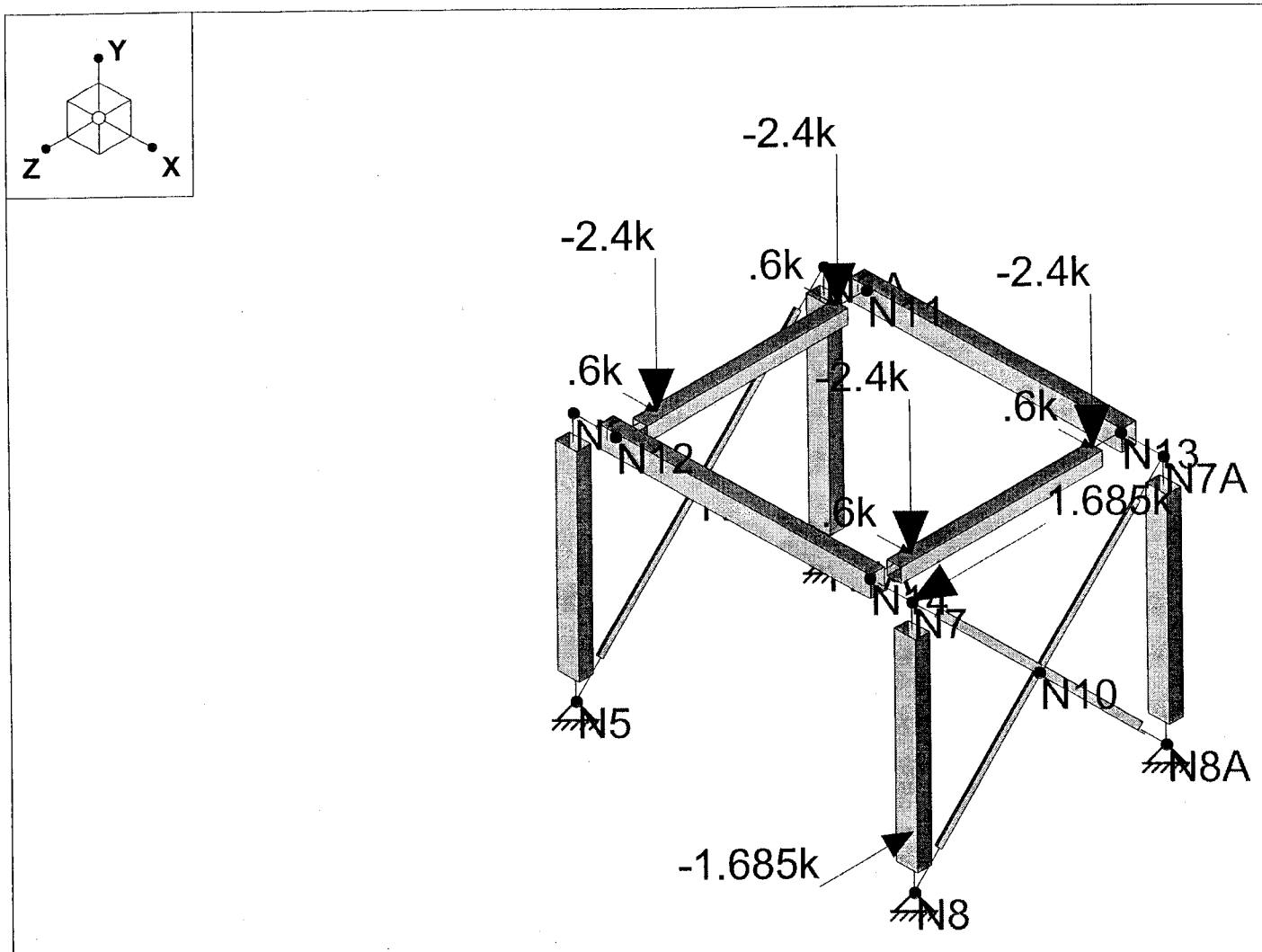
Label	Lc	Fa (ksi)	Ft (ksi)	Fb y-y (ksi)	Fb z-z (ksi)	Cb	Cm y-y	Cm z-z
M4	8	18.858	21.6	23.76	23.76	1.75	1	.6
M5	9	17.548	21.6	23.76	23.76	2.287	.6	.85
M6	9	18.858	21.6	23.76	23.76	1.75	1	1
M4A	8	18.858	21.6	23.76	23.76	1.75	1	.6
M5A	9	17.548	21.6	23.76	23.76	2.271	.6	.85
M6A	9	18.858	21.6	23.76	23.76	1.75	.6	1
M8	6	2.202	21.6	- Code check based on z-z Axial ONLY -				
M9	7	2.202	21.6	- Code check based on z-z Axial ONLY -				
M10	6	2.202	21.6	- Code check based on z-z Axial ONLY -				
M11	1	2.202	21.6	- Code check based on z-z Axial ONLY -				
M13	7	18.727	21.6	23.76	23.76	1.052	.85	.85
M14	8	18.727	21.6	23.76	23.76	1	.24	.85

6.2 Support Frame and Load Illustration



Loads: LC 9, asce 5 (b) jib z
Solution: Envelope

Intrepid Technology and Resources,...	kesley2	October 16, 2003
SD		3:03 PM
		RISA VACUUM FRAME.r3d



Loads: LC 9, asce 5 (b) jib z
Solution: Envelope

Intrepid Technology and Resources,...	kesley2	October 16, 2003
SD		3:03 PM
		RISA VACUUM FRAME.r3d

6.3 Weld Evaluations

INTREPID
Engineering Services, Inc.
A New Type of Engineering Company
501 West Broadway, Suite 200 Idaho Falls, ID 83402
(208) 529-5337

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

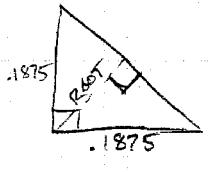
SCALE _____

- ALL JOINTS FIXED EXCEPT CONNECTIONS TO GROUND AND ANGLE SIDE BRACES.

WELD CONNECTION CALCULATIONS:
- PER BLODGET (REF. EDF-096 KNOCKDOWN HOPPER FRAME DESIGN)

1) JOINTS N6, N6A, N7, N7A (6x4x1/4 TUBE)
- MEMBER LOADS LOWER THAN INITIAL DESIGN

2) JOINTS N6, N6A, N7, N7A (2x2x1/4 ANGLE)
MAXIMUM LOAD 1.9 KIPS
TOTAL 6" WELD ASSUME 3/16" FILLET



$ROOT = \frac{.1875}{\sqrt{2}} = .133"$

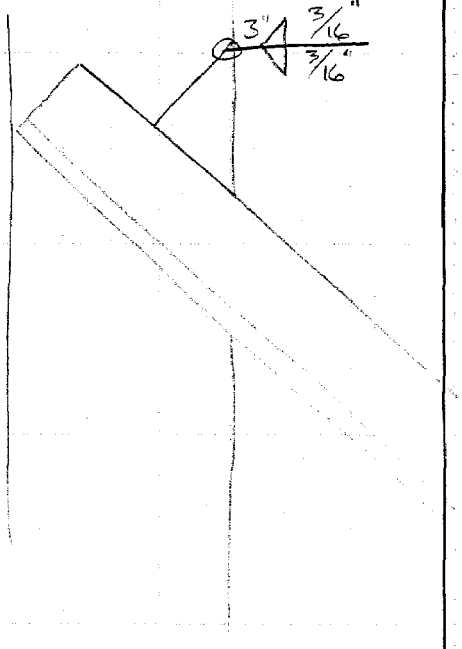
$\Rightarrow .133 IN^2/IN$ WELD

$\tau_A = .4\,\sigma_y \quad \sigma_y = 36 KSI$

$\Rightarrow \tau_A = 14.4 KSI$

$\tau_A(.133) = 1.9 KIP/IN \geq$ MAXIMUM LOAD

3/16" FILLET @ 6" TOTAL WELD LENGTH IS O.K.



INTREPID
Engineering Services, Inc.
A New Type of Engineering Company
501 West Broadway, Suite 200 Idaho Falls, ID 83402
(208) 529-5337

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

3) JOINTS N11, N12, N13, N14
(MEMBERS M13, M14)

MAXIMUM LOAD:

M14 (i)
- 1.466 ft-KIP — M_{z-z}
- 2.689 KIP — SHEAR Y-Y
- 0.459 KIP — AXIAL
- 1.071 ft-KIP — M_{y-y}

COMPARE TO:

M14 (i)
- 1.369 ft-KIP — M_{z-z}
- 1.283 ft-KIP — M_{y-y}
- 2.826 KIP — SHEAR Y-Y
- 0.532 KIP — AXIAL

-WITH ORIGINAL DESIGN

NEW DESIGN EXPERIENCES DECREASED LOADING. NO REVISION NECCESSARY.

4) JOINTS N5, N5A, N8, N8A

NEW DESIGN EXPERIENCES MORE CONSERVATIVE LOADING. NO REVISION NECCESSARY.

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Engineering Services, Inc.
A New Type of Engineering Company
501 West Broadway, Suite 200 Idaho Falls, ID 83402
(208) 529-5337

JOB _____

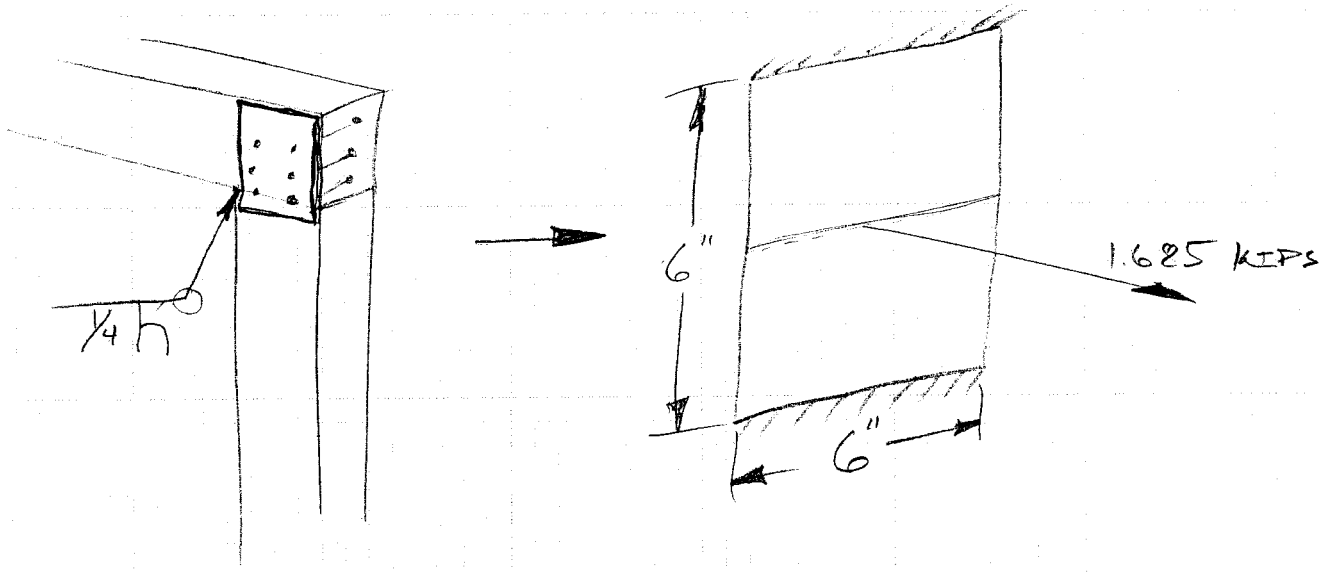
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

BEAM CRUSHING UNDER MOUNTING BRACKET LOADS:



WIDE SIDE OF BEAM MODELED AS A BEAM WITH MOUNTING BRACKET LOAD AS A POINT IN THE CENTER OF THE BEAM SPAN. THIS IS CONSERVATIVE FOR THREE REASONS:

- CENTROID OF THE LOAD IS NOT CENTERED ON THE BEAM WEB.
- THE LOAD IS DISTRIBUTED ABOUT 6 BOLTS.
- THE BEAM WEB IS SUPPORTED BY THE CONTINUING BEAM LENGTH.

THE LOWER MOUNTING POINT IS BOUNDED BECAUSE IT IS LOADED IN COMPRESSION AND BECAUSE IT IS MID-SPAN ON THE BEAM.

INTREPID
Engineering Services, Inc.
A New Type of Engineering Company
501 West Broadway, Suite 200 Idaho Falls, ID 83402
(208) 529-5337

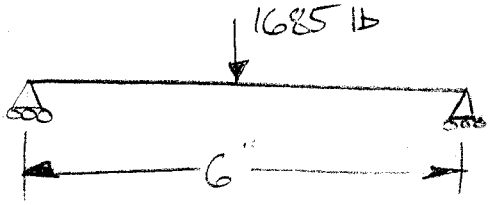
JOB _____

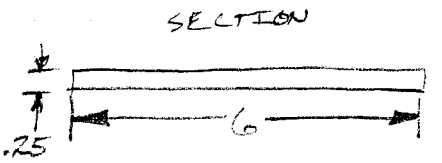
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____





$I = \frac{1}{12}(6)(.25)^3$

$= .0078$

$\sigma = \frac{My}{I}$ $\quad M = 1685(3) = 5055$ IN-LB

$y = .125$

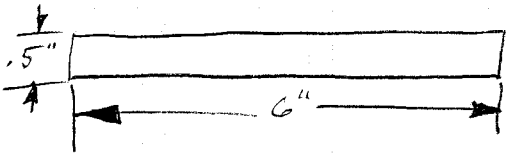
$\sigma = 80{,}880$ PSI $\gg \sigma_y = 36{,}000$ PSI

REINFORCEMENT:

ASSUME 1/4" PLATE WELDED ON FOR BACKING

- WELDS - 1/4" FILLET & U-GROOVE
  - ENSURES FULL STRENGTH OF 1/4" PLATE
  - RESISTS SHEAR OF APPLIED BENDING LOADS

NEW SECTION:



$I = \frac{1}{12}(6)(.5)^3 = .0625$

$y = .25$

$\frac{My}{I} = \frac{5055(.25)}{.0625} = 20{,}220$ PSI

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ALLOWABLE STRESS:

AISC ALLOWABLE STRESS DESIGN SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, 1989.

MEMBERS W/ NON-COMPACT SECTIONS

$$F_b = F_y\left[.79 - .002\frac{b_f}{2t_f}\sqrt{F_y}\right]$$

ASSUME $F_y = 36$ KSI (ASTM A36)

$$F_b = 36\left[.79 - .002\left(\frac{6}{2(.5)}\right)\sqrt{36}\right]$$

$$= 36(.718)$$

$$= 25.8 \text{ KSI} > 20.2 \text{ KSI LOAD STRESS}$$

1/4" BRACE PLATE FULLY WELDED WILL PREVENT TUBE CRUSHING UNDER MAXIMUM LOAD.

6.4 Bolt Loading Calculations

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(208) 529-5337

JOB

SHEET NO. OF

CALCULATED BY K. SHABER DATE 10/17/03

CHECKED BY DATE

SCALE

ASTM A325 BOLT LOADING

TOTAL LOAD - $P_T = 1685$ lbs

# of BOLTS - $N_B = 6$

LOAD PER BOLT - $\frac{P_T}{N_B} = 280.8 \frac{lb}{BOLT}$

BOLT HOLE SIZE - $11/16$

- ASSUME NOMINAL BOLT DIAMETER EQUAL TO $5/8"$

TENSILE STRESS AREA of $5/8"$ BOLT

$A_T = .2260 \text{ IN}^2$

STRESS PER BOLT

$$\sigma_A = \frac{280.8}{.2260} = 1242.6 \text{ PSI}$$

PROOF STRENGT of A325

$\sigma_p = 85 \text{ KSI} \gg \sigma_A$

- NO MINIMUM TORQUE LOADING

7.0 Appendix D – Initial Design

intrepid technology & resources incorporated

ENGINEERING DESIGN FILE

EDF-096- 019
Rev. No. _____

EDF Title: ICDF WAC Evaluation

Project No.: 2000-096	Project Title: OU 1-10, Group 3

Problem Statement:
An evaluation needs to be provided to determine if the TSF-26/PM-2A tank content waste is expected to meet the current ICDF Landfill Waste Acceptance Criteria.

Summary of Conclusions:

Based on existing information the waste streams identified for TSF-26 will be able to be disposed in the ICDF. The two main issues that remain open is 1) does the tank contents meet the LDR requirements for F001 hazardous waste, and 2) can the tank half sections be accepted into the ICDF for disposal. These issues will be worked using WGS services prior to the start of the removal activities.

Review and Approval Signatures:

	R/A	Printed Name	Signature	Date
Prepared by:		GARY MECHAM		10/20/03
Checked by:		KEVIN SHABER		10/20/03
Approval:		GARY MECHAM		10/21/03

Distribution:

Professional Engineer's Stamp (if required)

TAN TSF-26 WASTE COMPARISON TO THE ICDF LANDFILL WASTE ACCEPTANCE CRITERIA

The following information identifies the ICDF Landfill Waste Acceptance Criteria and evaluates the possibility of sending the tank content waste that will be removed from the PM-2A tanks during the OU 1-10, Group 3 remedial activities. The following sections address the criteria extracted from the ICDF Landfill Waste Acceptance Criteria.

Criteria #1 - Prohibited Waste

The wastes that are prohibited from disposal in the ICDF landfill are described in this section. The QA program will include a determination that no prohibited wastes are accepted for disposal to the ICDF landfill.

Waste With >10 nCi/g TRU Constituents

Waste containing greater than 10 nCi/g of TRU radionuclides is prohibited from disposal at the ICDF landfill in accordance with the OU 3-13 ROD (Appendix A, OU 3-13 Responsiveness Summary, Responses to comments #28, 226, and 230 [DOE-ID 1999]).

TSCA Waste Containing > 500 ppm PCBs

TSCA waste containing greater than 500 ppm of PCBs is prohibited from disposal at the ICDF landfill, in accordance with 40 CFR 761.60. No waste greater than 500 ppm of PCBs is expected, based on the inventory described in "INEEL CERCLA Disposal Facility Design Inventory" (EDF-ER-264).

Free Liquids

Waste containing free liquids is prohibited from disposal at the ICDF landfill, unless the liquids have been stabilized. If necessary, the presence of free liquids shall be determined by EPA Method 9095 ("Paint Filter Liquids Test") (EPA 1986) before shipment to the ICDF Complex.

Waste Capable of Detonation, Explosive Decomposition or Reaction

Waste capable of detonation or explosive decomposition is prohibited. This includes ordnance and explosive materials that may be encountered during excavation of waste. Generally, process knowledge will be used to make the determination that a waste is or is not capable of detonation or explosive decomposition, based on unexploded observable ordnance. If it is not clear based on process knowledge, specific testing of the waste may be required.

Waste Capable of Generating Toxic Gases, Vapors, or Fumes

Waste capable of generating toxic gases, vapors, or fumes harmful to persons transporting, handling, and disposing the waste (DOE Manual 435.1) is prohibited. The only allowable degradable wastes are wood, building demolition debris, PPE, and metals. Toxic gasses are not formed from the degradation of these materials.

Gaseous Waste

All gaseous waste containers must be empty and flattened.

Waste Exceeding the Class C Limit

Waste exceeding the Class C radioactive waste limit, as defined in 10 CFR 61.55, is prohibited.

Waste Containing Greater than 1% Chelating Compounds by Weight

Waste containing greater than 1% chelating compounds by weight is prohibited. Chelating compounds may mobilize constituents and cause exceedence of the RAOs. Examples of chelating compounds are glycinate, salicylate, chelidamic acid, and phthalic acid,

Spent Nuclear Fuel and High-Level Waste

Spent nuclear fuel and high-level waste (DOE Manual 435.1) are prohibited.

Volatile Organic Wastes >500 ppm

Organic wastes >500 ppm are prohibited (40 CFR 1082 [c][I]).

Based on the available sample results and characterization data the TSF-26 waste streams do not fall into the criteria of prohibited waste streams. The liquid that has been identified will be absorbed by adding additional diatamatious earth during the removal process.

Criteria #2 - Restricted Wastes Requiring Treatment

Table 1-1 lists the materials restricted from disposal to the ICDF landfill until specific conditions are met.

Table 1-1. Materials restricted from disposal at the ICDF landfill until the listed conditions have been met.

Restricted Material	Condition to be Met
Hazardous waste outside AOC	Hazardous waste from outside the AOC must be treated to meet UTSs.
Bulk disposal of waste containing free liquids	Free liquids must be eliminated by stabilization (adding materials to chemically immobilize the free liquids in the waste).
	If necessary, the presence of free liquids shall be determined by EPA Method 9095 ("Paint Filter Liquids Test") (EPA 1986) before shipment to the ICDF Complex.
Containerized waste holding free liquids, unless one of the following conditions has been met:	All freestanding liquid has been decanted, solidified with nonbiodegradable sorbent materials, stabilized, or otherwise eliminated[a].
	The waste has been converted into a form that contains as little freestanding and noncorrosive liquid as is reasonably achievable. In no case shall the liquid exceed 1% of the waste volume in a disposal container or 0.5% of the waste volume processed to a stable form[a].
LDR—Restricted waste	Must meet LDR requirements for 40 CFR 268.
Refrigerant-bearing equipment containing chlorofluorocarbons (CFCs)	CFC removal has been completed (40 CFR 82).
Pyrophoric waste	The waste must be treated, prepared, and packaged to be nonflammable prior to being disposed.
Infectious waste, as defined in 10 CFR 61 (including "any substance that may harbor or transmit pathogenic organisms," which may apply to septic tank sludge)	Special handling procedures will be developed.
pH <2 or >12.5	Neutralized.
Wastes containing >500 ppm volatile organics	Must be treated to reduce volatile organics to <500 ppm (40 CFR 26.1082 [c}[1]).
Trinitrotoluene (TNT) Royal Dutch explosives (RDX)	The waste must not be capable of detonation, explosive decomposition, or reaction at normal pressures and temperature, or explosive reaction with water.

a. A procedure for determination of free liquids is provided in the ICDF Complex O&M Manual.

In accordance with section 4 of the ICDF WAC, the wastes associated with TSF-26 do invoke the requirement to meet Land Disposal Restrictions applicable for the F001 listed hazardous waste components. A formal hazardous waste determination will need to be developed by Waste Generator

Services (WGS) for this waste. The wastes will then be evaluated against the applicable treatment standards or prohibition levels. The federal treatment standards and prohibition levels that apply to LDR waste are published in 40 CFR 268.48 and 40 CFR 264.49 (LDR treatment standards for soils). A list of the F001 listed waste treatment standards is provided in Table 1-2.

Table 1-2. LDR limits for F-listed hazardous wastes.

Waste Code	Waste Description	Regulated Hazardous Constituent	Regulatory Standard (mg/kg total, unless noted otherwise)	40 CFR 268.49 Alternative LDR treatment standards for contaminated soil[c]
F001, F002, F003, F004, F005	Listed spent solvent wastes	Acetone	160	1,600 mg/kg
		Benzene	10	100 mg/kg
		n-Butyl alcohol	2.6	26 mg/kg
		Carbon disulfide	(see 40 CFR 268)	480 mg/L TCLP
		Carbon tetrachloride	6.0	60 mg/kg
		o-Cresol	5.6	56 mg/kg
		m-Cresol	5.6	56 mg/kg
		p-Cresol	5.6	56 mg/kg
		Cresol mixtures	11.2	NA
		Cyclohexanone	(see 40 CFR 268)	7.5 mg/L TCLP
		o-Dichlorobenzene	6.0	60 mg/kg
		Ethyl acetate	33	330 mg/kg
		Ethyl benzene	10	100 mg/kg
		Ethyl ether	160	1,600 mg/kg
		Isobutyl alcohol	170	1,700 mg/kg
		Methanol	(see 40 CFR 268)	7.5 mg/L TCLP
		Methylene chloride	30	300 mg/kg
		Methyl ethyl ketone	36	360 mg/kg
		Methyl isobutyl ketone	33	330 mg/kg
		Nitrobenzene	14	140 mg/kg
		Pyridine	16	160 mg/kg
		Tetrachloroethylene	6.0	60 mg/kg
		Toluene	10	100 mg/kg
		1,1,1-Trichloroethane	6.0	60 mg/kg
		1,1,2-Trichloroethane	6.0	60 mg/kg
		1,1,2-Trichloro-1,2,2-trifluoroethane	30	300 mg/kg

Waste Code	Waste Description	Regulated Hazardous Constituent	Regulatory Standard (mg/kg total, unless noted otherwise)	40 CFR 268.49 Alternative LDR treatment standards for contaminated soil[c]
		Trichloroethylene	6.0	60 mg/kg
		Trichloromonofluoro methane	30	300 mg/kg
		Xylenes	30	300 mg/kg
		Chlorobenzene	6.0	60 mg/kg

a. TOC (total organic compounds).

b. Universal Treatment Standards.

c. When treatment of any constituent subject to treatment to a 90% reduction standard would result in concentrations less than 10 times the Universal Treatment Standard for that constituent, treatment to achieve constituent concentrations less than 10 times is not required (40 CFR 268.49 (c) (1)(c)).

d. Note: Table represents a partial list of waste codes most likely to be encountered during remediation activities at the INEEL. 40 CFR 268 will be consulted to ensure the applicable standard is used.

Criteria #3 - Physical and Chemical Criteria

Waste concentration limits and total quantity limits have been established for the ICDF. There is a provided within these values as a safety margin to provide flexibility in the waste acceptance process in case actual waste concentrations are higher than the ICDF design inventory. However, if waste characterization identifies waste concentrations that approach a WAC limit, the waste acceptance process will ensure protection of human health and the environment based on analysis of actual waste concentrations. These safety margins should adequately cover the uncertainty of concentrations that may be disposed at the landfill.

Liquid and Liquid-Containing Waste

For liquid-containing waste where condensate could form in inner plastic packaging (for example, bags) subsequent to packaging, the condensate shall be eliminated to the maximum extent practical by placing sorbents within the inner plastic packaging. In any case, the amount of liquid may not exceed 1% of the volume of the waste or 0.5% of waste processed to a stable form.

Residual liquids in large debris items shall be sorbed or removed. In cases where removing suspected liquids is not practical and sampling to determine if liquids are present is impossible, the liquids shall be removed to the maximum extent possible by draining suspected liquids at low points and placing an adequate amount of sorbent around each item. In any case, the amount of liquid cannot exceed 1% of the volume of the waste.

Land Disposal Restrictions

The application of LDRs for waste that is either a listed waste and/or characteristic waste depends on whether a waste originates from inside the WAG 3 AOC or has triggered placement.

Wastes originating inside the WAG 3 AOC (that have not triggered placement) are acceptable for direct disposal in the ICDF landfill without the need to meet the RCRA LDRs specified in the OU 3-13 ROD (DOE-ID 1999), provided that the waste meets the appropriate WAC limits.

Waste generated outside the AOC or that triggers LDRs, will use the LDR as the concentration limit for the hazardous constituent.

It is assumed that the TSF-26 waste streams meet the applicable LDR requirements. Additional sampling of the tank material will be performed prior to the start of the TSF-26 remedial activities to ensure that this assumption is valid and that treatment of the waste stream is not required.

Solidification or Stabilization of Organic Liquids and Chelating Compounds

Organic liquids and chelating compounds exceeding 1% of the waste by weight must be solidified or stabilized to a form that immobilizes the organic and chelating compounds.

Asbestos-Containing Waste

Asbestos-containing waste should be sent to the CFA bulk landfill unless the radionuclide content of the waste prevents this disposal. If the waste is radioactive, asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as it does not exceed applicable free liquid requirements. Disposal of asbestos waste will be in accordance with applicable state and federal regulations.

Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per m^3 (0.1 watt per ft^3), the package must be evaluated using the conversion factors in Appendix E to ensure that the heat does not affect the integrity of the container or surrounding containers in the ICDF landfill. This evaluation must be provided to and approved by the ICDF Complex Operations Manager.

Gas Generation

Gas generation from radiolytic or biological decomposition of containerized waste must be controlled to prevent pressurization exceeding 1.5 atmospheres (152 kilopascals absolute pressure), and combustible gas (for example, hydrogen, methane) concentrations exceeding the lower explosive limit during handling before disposal. Field methods for determining presence and amount of combustible gas can be used to demonstrate compliance with these criteria.

Physical Limits

Physical requirements may influence the disposal of certain waste types to the ICDF landfill, even when the waste satisfies other ICDF landfill WAC. Physical waste characteristics such as weight, volume, dimensions, or length may require adjustment before the waste is accepted for disposal.

Table 1-3 identifies the physical limits and restrictions that must be met before the waste types will be considered for disposal at the ICDF landfill.

Table 1-3. Physical limits for waste proposed for disposal at the ICDF landfill.

Waste Type	Limits and Restrictions
Steel Boxes	Steel boxes are assumed to be completely filled and, therefore, incompressible. Steel boxes with greater than 5% void space will not be accepted.
Concrete Debris	Concrete may be sent to the ICDF in one of two different forms: Reduced to rubble with a maximum dimension of approximately 1 ft. It is preferred that this rubble be mixed with other waste soil so that it can be handled as soil at the ICDF. Large blocks or slabs may be shipped under the following criteria: It must not exceed the gross weight limit for the container It must not extend above the side walls of the container It shall not exceed 20 ft in length, and must be loaded toward the rear of the box All rebar must be cut flush with the surface.
Steel Plate	Steel plate shall not exceed 4 ft in width or 8 ft in length. To minimize voids, steel plate shall not be bent or folded.

Waste Type	Limits and Restrictions
Rebar	Rebar should be cut to lengths of approximately 4 ft and mixed with soil to the extent practical. Rebar pieces where soil is not common can be placed in bulk roll-off containers with other hard debris.

Of the items listed under this criteria the only area that may be an issue is related to the physical limits associated with the tank sections. The plan is to work with ICDF personnel to figure a way in which the ICDF can accept the tank in half sections. This exceeds the steel plate size requirements as shown in table 1-3. If this issue can not be resolved then the tank sections will need to be cut and sectioned using a standard processor.

Criteria #4 - Radiological Criteria

Radiological Concentration Limits

The radiological concentration (activity limits) are given in Table 5-2 of the ICDF Landfill WAC. Table 1-3 compares the radionuclide WAC limits to the radionuclide characterization data for the TSF-26 waste contents.

Table 1-3. Radionuclide comparison of TSF-26 waste and the ICDF landfill Waste Acceptance Criteria.

Constituent[a]	TSF-26 Tank Waste Average Concentration [a] (pCi/g)	TSF-26 Tank Waste Maximum Concentration [a] (pCi/g)	Selected WAC Concentration Guideline (mg/kg or pCi/g)
Radionuclides			
Ag-108m			8.0E + 02
Am-241	1.569E+02	4.71E+02	1.0E + 04
Am-243			3.3E - 01
Ba-137m			No Limit
C-14			3.0E + 00
Cd-113m			1.6E + 03
Ce-144			1.8E + 00
Co-57			3.7E + 00
Co-60	7.792E+03	2.52E+04	1.9E + 05
Cs-134			1.1E + 04
Cs-137	4.644E+05	1.170E+06	2.3E + 09
Eu-152			9.7E + 05
Eu-154	2.121E+03	6.94E+03	8.2E + 05
Eu-155			1.8E + 05
H-3			5.0E + 04
I-129			3.1E + 00
K-40			2.4E + 02
Kr-85			No Limit
Np-237			6.4E + 02
Pm-147			3.8E + 05
Pu-238	5.434E+02	1.710E+03	1.0E + 04
Pu-239	7.242E+02	2.140E+03	6.7E + 03
Pu-240	7.242E+02	2.140E+03	1.5E + 03
Pu-241			6.4E + 04
Ra-226			4.7E + 02
Ru-106			1.2E + 01

Constituent[a]	TSF-26 Tank Waste Average Concentration [a] (pCi/g)	TSF-26 Tank Waste Maximum Concentration [a] (pCi/g)	Selected WAC Concentration Guideline (mg/kg or pCi/g)
Sb-125			9.3E + 03
Sm-151			3.4E + 05
Sr-90	1.41E+06	4.57E+06	3.5E + 09
Tc-99			5.8E + 03
Te-125m			2.3E + 03
Th-228	3.45E+01	3.45E+01	1.6E + 01
Th-230			1.4E + 01
Th-232			1.7E + 01
U-233	6.481E+02	1.78E+03	2.6E - 02
U-234	6.727E+02	1.86E+03	6.0E + 03
U-235	2.396E+01	6.78E+01	1.1E + 02
U-236	4.545E+00	1.26E+01	2.0E + 02
U-238	5.135E+00	1.41E+01	2.0E + 03
Y-90			2.3E + 07

a. Values were taken from EDF-3260.

The highlighted values exceed the ICDF WAC limits when doing a direct comparison with the values used in EDF-3260, "Hazard Assessment Calculation for Hazard Classification for PM-2A Tanks, V-13 and V-14". When evaluating these values it can be determined that they will not prohibit the waste from being able to meet the waste acceptance criteria.

The Pu-240 value that exceeds the WAC limit is based on the highest sample results seen within the sludge material. During the waste removal operations the sludge and diatamatious earth materials will be mixed together prior to being removed from the tank. By doing so the Pu-240 concentration will be less than the ICDF WAC.

The Th-228 data is based on one sampling performed in 1996. Applying the 2 year half-life for Th-228 shows that this contaminant should be relatively gone at this point and should not be an issue. This will be confirmed in the upcoming sampling activities planned for the tank contents.

The concentrations listed for U-233 represent a value that is comprised of both the U-233 and U-234 concentrations. Because there is no way of determining what the proportionality of the U-233 vs U-234 was at the time of the analysis, the total summed value was used for both constituents in EDF-3260. It is process knowledge that typically the concentration of U-233 is considerably lower then the concentration of U-234. This is made evident in the fact that the ICDF WAC has such a large difference in the allowable concentration limits. If the ratio between these constituents used for the ICDF WAC is applied to the TSF-26 values then the estimated U-233 concentration would be approximately 2.8E-3 pCi/g. This is well below the ICDF WAC limit. These two constituents will have separate analysis performed during the upcoming tank content sampling activites.

Radiological Inventory Limits

The radiological inventory limits for the ICDF landfill will be maintained to stay within the facility safety envelope and authorization basis. These inventory limits are to be less than a Hazard Category 3 Nuclear Facility.

Criticality Safety Limits

Criticality Safety Limits are described in Section 5.4.3 of the ICDF Complex WAC (DOE-ID 2002a), Table 1-1.

Package External Concentration Limits

Package External Concentration Limits are described in Section 5.4.4 of the ICDF Complex WAC (DOE-ID 2002a), Table 1-1.

Package Dose Rate Limits

Package Dose Rate Limits are described in Section 5.4.5 of the ICDF Complex WAC (DOE-ID 2002a), Table 1-1.

Non-Contact-Handled Waste

Non-contact-handled waste shall meet the applicable dose rate restrictions of Department of Transportation or an approved packaging safety analysis. Remote-handled waste shall be configured for unloading such that personnel exposures are maintained ALARA.

Based on available data none of these criteria will cause the waste to not be acceptable into the ICDF.

EDF Title: **TSF-26 PM2A TANK PACKAGING SYSTEM**

Project No.: 2000-096	Project Title: OU 1-10, TSF-26 REMEDIATION

Project Specific Activity: PM2A TANK PACKAGING SYSTEM

Problem Statement:

Provide Recommended PM2A Tank Packaging System to allow the tank halves to be packaged for shipment from TAN TSF-26 Site to the ICDF located at INTEC. The items to be considered are outlined below:

- Commercial Availability
- Material Cost and Durability
- Operational Safety

Summary of Conclusions:

PM2A Tank Packaging System ==> 18 ounce, vinyl laminate, yellow:

- Option 1 - Flat Sheet and Wrap System
  - $1,818 each
- Option 2 - Burrito Bag System
  - $1,583 each

REVIEW AND APPROVAL SIGNATURES:

	R/A	TYPED NAME/ORGANIZATION	SIGNATURE	DATE
PREPARED BY:		D. J. Kenoyer		21 Oct 03
CHECKED BY:		KEVIN SHABER		10/20/03
INDEPENDENT REVIEWER				
APPROVAL:		GARY MECHAM		10/21/03

Distribution:

Registered Professional Engineer's Stamp (if required)

PROBLEM STATEMENT:

TSF-26 Site Remediation Operations require the removal of PM2A Tank halves, packaging, and transportation to the ICDF at the INTEC Site. :

- Commercially available 18 ounce, vinyl laminate, yellow ["Yellow" for typical Radiological Waste packaging]
- Local Manufacturer to produce configuration of selected packaging system [Option 1 or 2]
- Relatively low NEW Cost and Simple Application

ASSUMPTIONS:

The Assumptions utilized in the performance of these calculations are outlined below:

- Plastic Wrapping or Bagging System Configuration
- Spray System Configuration

REFERENCES:

- Quote from Idaho Canvas Products, Inc. dated 16-Oct-03
- Email from INEEL BBWI Dave Eaton, dated 16-Oct-03 @1730 MST ==> InstaCote SE

CALCULATIONS / ANALYSIS:

See Attached Quote from Idaho Canvas Products, Inc. dated 16-Oct-03. Potential problem to overcome with the burrito bag packaging system is the getting around the lifting straps utilized to hold the PM2A Tank halves. The bag could be pulled onto the tank up to the lifting straps and larger dunnage blocking would be placed under the PM2A Tank half to provide a gap under the lifting straps when PM2A Tank half placed back down on the dunnage blocking. This would allow the lifting straps to be disconnected and the bag moved past the lifting straps to a point where the PM2A Tank half does not clear the dunnage blocking. The bag would have to be cut to allow the lifting straps to pass through and be reconnected to the crane hoisting system. The bag opening (cut holes) for the lifting straps would be taped closed (taped to lifting straps and bag material). This process would be repeated for the other lifting strap on the PM2A Tank half.

See additional Attached information on InstaCote SE (Sprayable Elastomer) system. Potential problem to overcome with spray coating system is the confinement of loose materials that would be airborne due to spray pressures of coating materials. The top half of the PM2A Tanks could be coated prior to lifting by employing a similar approach to spraying fixative on surface that was previously rejected by INEEL BBWI Technical Representatives. This would include cutting additional access holes into the side of the tanks to allow spray wand access to coat the interior of the tank prior to placing slings for lifting. There is another problem with "fall out" from the spraying operations when some of the material falls out of suspension in the air to the tank waste at the bottom of tank. This must then be overcome during waste breakup and vacuuming operations.

- InstaCote - Home Page, 1 page
- InstaCote - Services, 1 page
- InstaCote - Products, 1 page
- InstaCote - InstaCote SE, 1 page
- InstaCote - InstaCote SE Technical Specification, 1 page
- InstaCote - Contact, 1 page
- InstaCote - InstaCote SE MSDS, 9 pages

IDAHO CANVAS PRODUCTS, INC.

195 Northgate Mile P.O. Box 50856, Idaho Falls, ID 83405
(208) 522-3160 Tel (208) 522-3180 Fax
www.idahocanvas.com

October 15, 2003

Intrepid Technology Resources Inc
Attn: C. Scott Francis
Fax: 5291014

Scott,
Here are our preliminary ideas / estimates on the different covers for the INEEL PM-2A tanks.

Option #1 (see attached drawing) Flat wrap around tarp with boxed ends.

Costs:

Fabric –	$1,188.00 (164 yards 18oz. vinyl laminate, yellow @ $7.24 p/yd)
Fasteners -	$ 90.00 (webbing, buckles, rope, reinforcements)
Labor -	$ 540.00 (cutting, seaming, sewing, final assembly)

TOTAL EST $1,818.00 ea. ✓

Option #2 (see attached drawing) Pull on tube with one open end.

Costs:

Fabric –	$1,188.00 (164 yards 18oz. vinyl laminate, yellow @ $7.24 p/yd)
Fasteners -	$ 35.00 (webbing, buckles, rope, reinforcements)
Labor -	$ 360.00 (cutting, seaming, sewing, final assembly)

TOTAL EST $1,583.00 ea. ✓

We would have to order 1000 yards of fabric to complete this order. Thus our estimated lead time for production would be 2-3 weeks. We could call you as the covers are completed so you could arrange to pick them up 1-2 at a time as we finish them.

Please contact me with any concerns or questions.

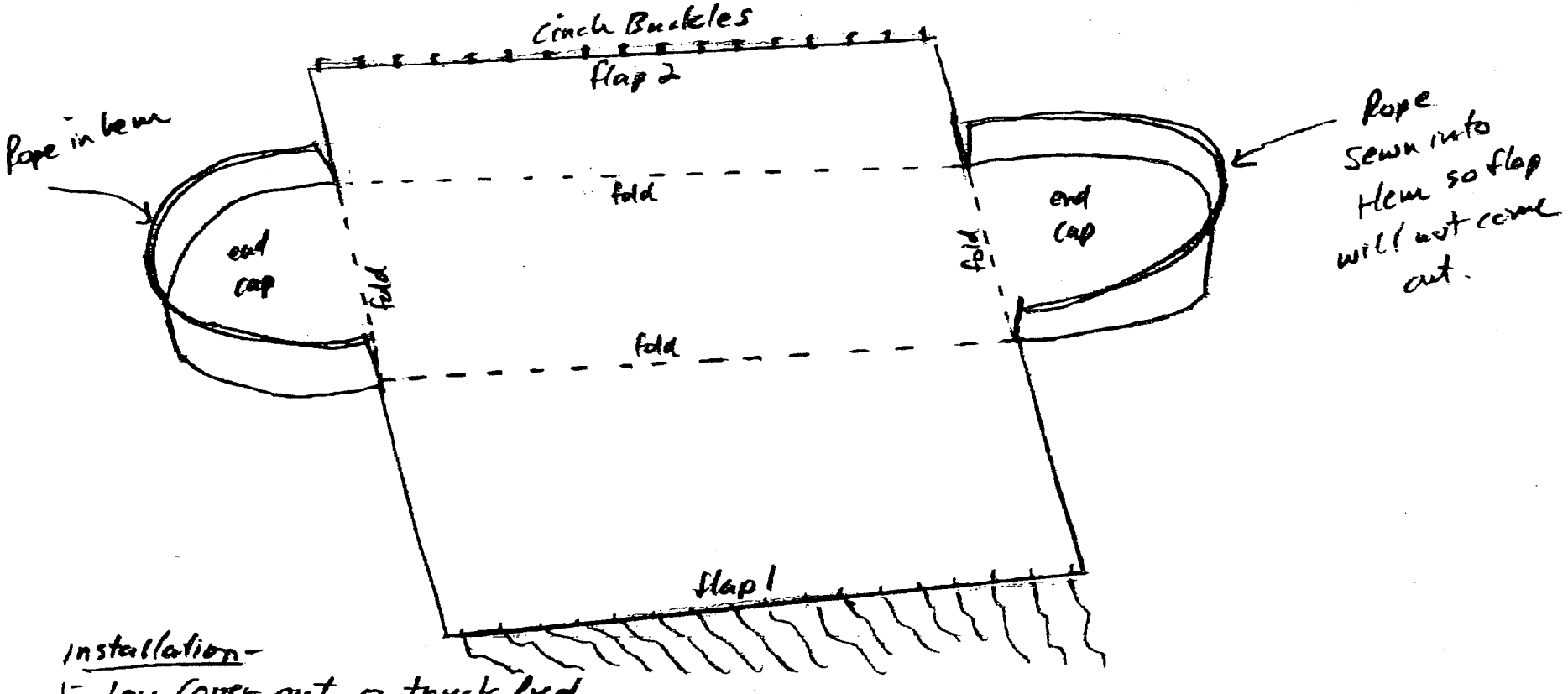
Thanks,

Lorin Rigby

Lorin Rigby
Idaho Canvas Products, Inc.

Option #1

Flat, wrap around tarp w/ Boxed ends

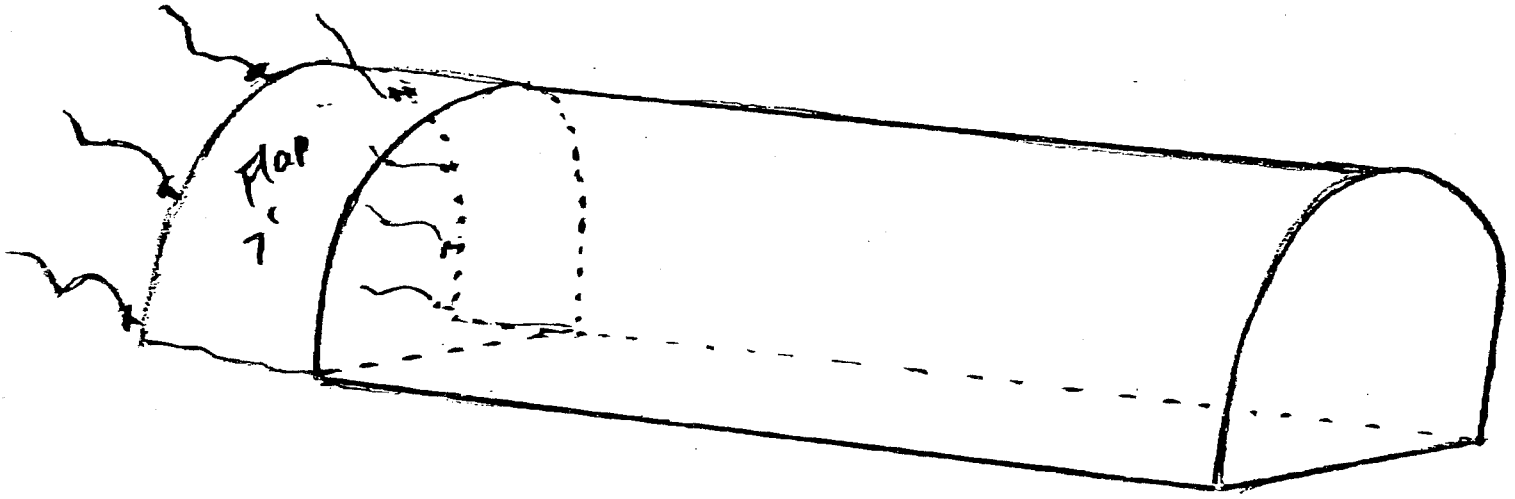


Installation-

1- Lay cover out on truck bed
2- Place tank on top of cover in proper position
3- fold end caps up around tank ends
4- fold flap 1 over top of the tank and fasten to cinch buckles on flap 2

Option #2

Pull on tube with one open end.



★ this install will be difficult !!

★ installation -

1- Lift tube off ground (one end)
2- Slide tube on one end and pull along tank until fabric is all on.
3- lift other end of tank and slide fabric along until tank is enclosed
4- Fold flap around open end and secure.
5- Lift tank onto platform

Don Kenoyer

From: Lynn Higgins [lhiggins@intrepid21.com]
Sent: Thursday, October 16, 2003 5:30 PM
To: G Mecham; D Kenoyer
Subject: Fw: alternative packaging for large items such as tank halves

You guys are gonna love this one - deja vu?????

----- Original Message -----
From: DLE@inel.gov
To: GKK@inel.gov
Cc: jharris@inel.gov ; gem2@inel.gov ; jj3@inel.gov ; ejj@inel.gov ; mde@inel.gov ; AJZ@inel.gov
Sent: Thursday, October 16, 2003 4:18 PM
Subject: alternative packaging for large items such as tank halves

Gene,
Have we taken a look at Instacote packaging yet. I talked with some of the guys at Rocky Flats and they love it. Essentially you spray on the coating and that serves as the DOT packaging. If we are interested, one of the Rocky guys said he could fly up here and make a presentation.

The application that I see in mind is the PM-2A tanks. Right now we plan on cutting these two 50,000 gallon (55 ft x 12.5ft dia) tanks in half lengthwise. After removing the waste from the inside, we would then wrap each half in plastic and ship to ICDF for disposal. There they would have to remove plastic to nest or stack the tank halves. Wrapping them in plastic seems to me to not be so simple.

As I understand the instacote system, they just spray on the polyurea coating, let it dry, and it meets DOT requirements. (I don't know what level of DOT packaging requirements it meets. It's probably limited to IP-1,2 and SCO-1,2.)

I don't know what the empty tanks weigh, but if we can meet the weight limits for transportation, we might want to do the nesting at TAN and then spray then as one unit.

Anyway, I think we ought to consider using this type of packaging. If you want to talk to the guy at Rocky, he is Kent Dorr

Kent A. Dorr
Kaiser-Hill L.L.C. Project Manager
Rocky Flats Plant, Golden Colorado
W 303-966-6034' Cell 303-994-0875

Thanks

Dave

InstaCote™ SE (Sprayable Elastomer)

InstaCote™ is a plural component, rapid curing sprayable polyurea elastomer. InstaCote™ Polyurea elastomer is 100% solids with no VOC emissions. InstaCote™ Polyurea elastomer cures to a tack free surface in less than 10 seconds to yield an extremely tough, durable coating with a tensile strength of 2500-2800 psi, elongation of 280%, Thermal Shock value of -65° F with a service temperature of up to 350°F. InstaCote™ is unaffected by ambient humidity at the time of application and totally impervious to moisture immediately following application. When applied, InstaCote™ SE packaging system serves as a strong, tight container for over the road transport of oversized LLW. This "Spray-on Container" forms a very strong penetration-resistant coating that meets or exceeds DOT regulations for shipment and waste acceptance criteria at the final disposal site. The InstaCote™ SE packaging system components can be modified and specifically engineered to provide solutions to a wide range of waste disposal problems inherent in the packaging and transport of hazardous materials.

David L. Eaton
WAG 1/Mixed Waste Technologies
Phone 208-526-7002
Cell 208-520-3714
Fax 208-526-1061
Email dle@inel.gov

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Innovative products and outstanding customer service have made us the preferred choice among D&D and Remediation Service Providers.

Our staff of engineers and chemists includes current DOE Q cleared personnel with hands on remediation and D&D experience throughout the DOE weapons complex.

Our research and development investment, twice the national average, is the cornerstone of our ability to deliver engineered products. We will recommend a solution only after we've had a chance to evaluate your site and assess your needs.

The focus at InstaCote™ is to provide the best possible chemistry to address your specific radiological concerns. On-site consulting and training are part of our involvement with our customers.

InstaCote™ has become a dedicated partner with the DOE. Our experienced staff of chemists and engineers are working toward the common goal for facility closures throughout the weapons complex.

Our family of radiological products continues to grow. Let us work with you to insure you have the best possible chemistry and materials to solve your contamination problems.

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- On-site product training.
- Research and development of new products to meet specific customer needs.
- Our involvement with our customers doesn't stop with on-site training. We perform follow-up visits to insure you receive the maximum benefits our contamination control products have to offer. Experts are never more than a call away to answer any question you may have.
- Our technical staff, with years of experience at The Department of Energy Nuclear Facilities, is able to provide consulting services in the areas of: health physics, control of contamination, and decommissioning.

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Our Products

CC Wet (Contamination Control Wetting Agent) is used to reduce airborne contamination in the workplace and to prevent contamination from becoming airbourne during work activity.

CC Strip (Contamination Control Strippable) is used to decon surfaces contaminated with plutonium and uranium.

CC Fix (Contamination Control Fixative) is used to fix contaminates to a surface.

CC Epoxy 609 (Contamination Control Epoxy 609) is poured into process piping (in-situ) to permanently fix contamination.

BASF Autofroth™ Structural Expanding Foam is used to block and brace large items in waste packaging.

InstaCote™ SE soft sided containment/packaging of oversized low level waste for over the road transport.

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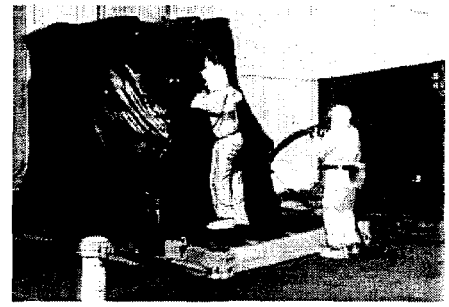
InstaCote™ SE (Sprayable Elastomer)



MSDS

Technical Data Sheet

InstaCote™ is a plural component, rapid curing sprayable polyurea elastomer. InstaCote™ Polyurea elastomer is 100% solids with no VOC emissions. InstaCote™ Polyurea elastomer cures to a tack free surface in less than 10 seconds to yield an extremely tough, durable coating with a tensile strength of 2500-2800 psi, elongation of 280%, Thermal Shock value of -65° F with a service temperature of up to 350°F. InstaCote™ is unaffected by ambient humidity at the time of application and totally impervious to moisture immediately following application.When applied, InstaCote™ SE packaging system serves as a strong, tight container for over the road transport of oversized LLW. This "Spray-on Container" forms a very strong penetration-resistant coating that meets or exceeds DOT regulations for shipment and waste acceptance criteria at the final disposal site. The InstaCote™ SE packaging system components can be modified and specifically engineered to provide solutions to a wide range of waste disposal problems inherent in the packaging and transport of hazardous materials.

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InstaCote SE

Polyurea Coating

Typical Physical Properties

	WET		
Solids			
By Weight	100%		
By Volume	100%		
VOC	0.0 lbs/gal		
Coverage	Thickness	Area	Usage
	30 mil (1/32")	1 sq/ft	0.15 lbs
	60 mil (1/16")	1 sq/ft	0.32 lbs
	90 mil (3/32")	1 sq/ft	0.40 lbs
	120 mil (1/8")	1 sq/ft	0.58 lbs
	180 mil (3/16")	1 sq/ft	0.82 lbs
Weight/gallon	9 lbs combined		
Viscosity			
A Component (Isocyanate)	800-1200 s/cps @ 25° C		
B Component (Amine polymer)	700-1000 s/cps @ 25° C		
Cure Times	45 seconds		
Gel	2 seconds		
Tack Free	25 seconds		
Post Cure	24 hours		
Recoat	Within 2 hours		
Shelf life	indefinite		
Clean up solvent	Xylene, MEK, Isopropyl alcohol, Methyl Pyrolidone		
Thinner	Never Recommended		
	CURED		
Stress/tensile strength	2500-2900 psi		
Elongation @ 25° C (77o F)	280%		
Hardness	54 Shore D		
100% Modulus	1700-1900 psi		
Tear Strength Ply	410 PLI		
Thermal Shock	-65° F with no effect		
Impact notched	320 inches/flash pounds		

InstaCote, Inc.
150 C. Lavoy Rd.
Erie, Michigan, USA 48133
Phone (734) 847-5260 Fax (734) 847-9008

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Contact Us!

If you decide to perform your own InstaCote™ application, we will evaluate, supply and then train your applicators. Our trained staff has over 16 years experience of in house and field application experience.

Should you choose InstaCote™ to perform your application, the highly trained staff will safely and effectively apply the product. Product satisfaction and turn around time is guaranteed. Facility tours and reference are available upon request.

E-mail us at info@instacote.com or call us at 734-847-5260.

InstaCote, Inc.
160 C. Lavoy Road
Erie, MI 48133

MATERIAL SAFETY DATA SHEET

Trade Name: InstaCote™ SE Cured Plastic

Section I -General Information

Item Name: InstaCote™ SE Cured plastic

Manufacture: InstaCote, Inc.
160 C. Lavoy Road
Erie, MI 48133
Phone 734-847-5260
Fax 734-847-9008

Date MSDS Prepared: July 8, 2002
Last Review Date: July 8, 2002
MSDS Preparers Name/Address: prepared by manufacturer.
Product Description: MDI Polyurea Plastic
Multiple Part Product (Y/N): Y (Finished Part of "A & B" of this 2 part system)

Proprietary (Y/N): Y

Section II – Ingredient/Identity Information

Not hazardous

Section III Physical/Chemical Characteristics

Appearance and Odor: No odor, color usually black
Boiling Point: Not determined
Melting Point: Not determined
Vapor Pressure: Not determined
Vapor Density: Not determined
Specific Gravity: Not determined
Evaporation Rate: Not determined
Solubility (H_2O): None
Percent Volatiles by Volume: less than 0.001%
Viscosity: None solid
pH: Not applicable

Section IV - Fire and Explosion Hazard Data

Flash Point: N/A
Lower Explosive Limit: Not determined
Upper Explosive Limit: Not determined
Extinguishing Media/Methods: Use dry chemical, CO_2, AFFF (foam), or water.
Special Fire Fighting Precautions: Full face shield, self contained breathing apparatus with full protective gear.
Unusual Fire/Explosive Hazards: See Omega Labs Fire testing results

Section V - Reactivity Data

Stable (Y/N): Y
Conditions to Avoid: Temperature in excess of 350°F
Materials to Avoid: Concentrated strong acids
Hazardous Decomposition Products: Oxides of Carbon, Oxides of Nitrogen, ammonia, aldehydes and ketones

Section VI - Health Hazard Data

Routes of Entry
Inhalation (Y/N): N
Skin (Y/N): N
Ingestion (Y/N) N
Other: (Y/N) N

Contact Eye/Skin Hazards: (Y/N) N
Carcinogenicity Data: (Y/N) N
IARC Monographs on the Evaluation of the Carcinogenic: (Y/N) N

First Aid Procedures:

Gross Ingestion: (Y/N) N
Gross Inhalation: (Y/N) N
Skin Contact - (Y/N) N
Severe Eye Contact - (Y/N) N

Section VII - Precautions for Safe Handling and Use

Personal Protective Equipment (Routine Use):

Respiratory Protection: (Y/N) N
Gloves: (Y/N) N
Eye Protection: (Y/N) N
Other: Recommend Tyvek suits or coveralls.

Work Practices: (Y/N) N
Ventilation: (Y/N) N
Spill/Release Procedures: (Y/N) N
Neutralization Procedures:

Waste Disposal Procedures: (Y/N) N
Storage/Handling Procedures: (Y/N) N

MATERIAL SAFETY DATA SHEET

Trade Name: InstaCote™ SE Resin, Part "B"

Section I -General Information

Item Name: InstaCote™ SE Resin, Part "B"

Manufacture: InstaCote, Inc.
160 C. Lavoy Road
Erie, MI 48133
Phone 734-847-5260
Fax 734-847-9008

Date MSDS Prepared: December 6, 1995
Last Review Date: March 6, 2002
MSDS Preparers Name/Address: prepared by manufacturer.
Product Description: Liquid aromatic polyamine/polyoxyalkyleneamine with An ammoniacal odor of various colors
Multiple Part Product (Y/N): Y (ISO Part "A" is other half of this 2 part system)

Proprietary (Y/N): Y

Section II – Ingredient/Identity Information

Ingredient	CAS #	Exposure Limits (TWA)
Aromatic Amine mixture	Proprietary	
Polyoxyalkyleneamine	9046-10-0	Not established
Diethyltoluenediamine	68479-98-1	Not established

Various pigments and or dyes can be present

Product is listed or hazardous according to one or more state Right To Know (SARA III) or federal Toxic Chemical Release Inventory, or Toxic Substance Control Act Laws.

Section III Physical/Chemical Characteristics

Appearance and Odor: Colored, glossy liquid with ammoniacal odor
Boiling Point: Not determined
Melting Point: Not determined
Vapor Pressure: Not determined

Vapor Density: Not determined
Specific Gravity: 1.014 @ 69°F
Evaporation Rate: Not determined
Solubility (H_2O): <0.02% by wt. @ 69°F
Percent Volatiles by Volume: less than 0.001%
Viscosity: 855 cP (Brookfield, #2 spindle @ 12rpm, @ 69°F)
pH: Not applicable

Section IV - Fire and Explosion Hazard Data

Flash Point: > 275°F
Lower Explosive Limit: Not established
Upper Explosive Limit: Not established
Extinguishing Media/Methods: Use dry chemical, CO_2, AFFF (foam), or water.
Special Fire Fighting Precautions: None
Unusual Fire/Explosive Hazards: None

Section V - Reactivity Data

Stable (Y/N): Y
Conditions to Avoid: None
Materials to Avoid: Do not mix with nitrites, May react violently with acids.
Hazardous Decomposition Products: Oxides of Carbon, Oxides of Nitrogen, ammonia, aldehydes and ketones

Section VI - Health Hazard Data

Routes of Entry

Inhalation (Y/N): Y, May cause respiratory tract irritation (pulmonary edema), nasal discharge, coughing and chest pain. Prolonged exposure may result in permanent lung damage.

Skin (Y/N): Y, Product is expected to be toxic by dermal absorption.

Ingestion (Y/N): Y, May cause digestive tract irritation and respiratory tract irritation and lung damage upon aspiration.

Other: Y, Acute vapor exposure may temporarily cause hazy or blurred vision.

Contact Eye/Skin Hazards: This product is highly corrosive and may cause severe burns, redness, swelling, and blistering upon direct contact.

Carcinogenicity Data: No human carcinogenic data is available. Evidence of limited tumor

growth
in animals.

IARC Monographs on the Evaluation of the Carcinogenic: None available.

First Aid Procedures:

Gross Ingestion: If victim is conscious, give at least two glasses of water. Do not induce vomiting. Seek immediate medical attention. Physician should evacuate stomach by means least likely to cause aspiration.

Gross Inhalation: Move victim to fresh air environment. Seek immediate medical attention. Notify physician of corrosive nature of chemical.

Skin Contact - Wash affected areas with soap and water. Laundry soiled clothing before reuse.

Severe Eye Contact - Flush eyes with water for 15 minutes. Seek medical attention.

Section VII - Precautions for Safe Handling and Use

Personal Protective Equipment (Routine Use):

Respiratory Protection: In cases when excessive mists might be periodically created, use NIOSH/MSHA approved full or half face respirators with dust cartridges when pouring and mixing product.

Gloves: Recommend latex, butyl rubber, or nitrile gloves.

Eye Protection: Safety goggles or glasses recommended.

Other: Recommend Tyvek suits or coveralls.

Work Practices: This product is to be used both outdoors and in enclosed environments with adequate respiratory and, or ventilation controls. Do not use in presence of flames or sparks.

Ventilation: If routine indoor use is required, or in the presence of excess mist generation, local exhaust ventilation is recommended.

Spill/Release Procedures: Excess spilled product, if uncontaminated, may be cleaned and disposed of as ordinary waste. No special clean up procedures are recommended.

Neutralization Procedures:

Waste Disposal Procedures: This material is not a listed hazardous waste, nor does it exhibit any hazardous waste characteristic.

Storage/Handling Procedures: Store product in a dry environment, away from strong acids and oxidizers.

End

MATERIAL SAFETY DATA SHEET

Trade Name: InstaCote™ SE Isocyanate Part "A"

Section I -General Information

Item Name: InstaCote™ SE Isocyanate, Part "A"

Manufacture: InstaCote, Inc.
160 C Lavoy Road
Erie, MI 48133

Date MSDS Prepared: December 6. 1995
Last Review Date: March 6, 2002
MSDS Preparers Name/Address: Prepared by manufacturer.
Product Description: Pre-polymerized Isocyanate Blend.
Multiple Parts Product (Y/N): Y

Section II – Hazardous Ingredient/Identity Information

Proprietary (Y/N): Y

Ingredient	CAS #	Exposure Limits (TWA)
4, 4'-diphenylmethane Di-isocyanate	101-68-8	0.02 ppm ceiling limit, OSHA 0.005 ppm ACGIH TLV, TWA
Mixed Isomers	26447-40-5	0.02 ppm ceiling limit, OSHA 0.005 ppm TLV, ACGIH

Section III-Physical/Chemical Characteristics

Appearance and Odor. Clear, amber color thick liquid with faint odor
Boiling Point: 738°F
Melting Point: 99°F
Vapor Pressure: 0.001 mm Hg @ 130°F
Vapor Density: No data
Specific Gravity: 1.140 @ 72°F
Decomposition Temp.: Above 738°F
Evaporation Rate: No data
Solubility (H_2O): 0.2% by wt @ 68°F
Percent Volatiles by Volume: unknown
Viscosity: 1300 cP (Brookfield #2 spindle @ 12 rpm) 72°F
pH: Not applicable

Section IV - Fire and Explosion Hazard Data

Flash Point: 396°F C.O.C.
Lower Explosive Limit: Not Determined
Upper Explosive Limit: Not Determined
Extinguishing Media/Methods: Use dry chemical, CO_2, AFFF (foam). If only water is available Use very large volume. Reaction with water at elevated temperatures may be violent. Runoff water must be retained.
Special Fire Fighting Precautions: Full face shield, self-contained breathing apparatus with full protective gear.
Unusual Fire/Explosive Hazards: Isocyanate and water combined react to produce carbon dioxide. Contaminated, sealed containers may rupture.

Section V - Reactivity Data

Stable (Y/N): Y
Conditions to Avoid: High temperatures
Materials to Avoid: Product may react violently with water, alcohol, amines, acids, bases.
Hazardous Decomposition Products: Oxides of carbon, oxides of nitrogen, ammonia and trace amounts of Hydrogen cyanide.
Hazardous Polymerization: May occur. Avoid contamination with liquid water or water vapor.

Section VI - Health Hazard Data

Routes of Entry

Inhalation (Y/N): Y, May cause respiratory tract irritation(pulmonary edema, nasal discharge, coughing, chest pain. This product may cause respiratory sensitization, in which, after repeated exposures above the occupational exposure limit, hyper-reactive responses may occur in sensitized individuals following minimal doses.

Skin (Y/N): Y, Product exhibits skin sensitization. Some evidence indicates that skin contact may induce a respiratory sensitization reaction.

Ingestion (Y/N): Y, May cause digestive tract and gastrointestinal tract. Systemic ingestion effects are practically non-toxic.

Other: Y, Acute vapor exposures may temporarily cause hazy or blurred vision.

Contact Eye/Skin Hazards: Y, Product is a mild eye and skin contact irritant.
Carcinogenicity Data: No human or animal carcinogenic data is available.
IARC Monographs on the Evaluation of the Carcinogenic: None

First Aid Procedures:

Gross Inhalation: Move victim to fresh air environment. First administer oxygen, if available. Seek immediate medical attention.

Gross Ingestion: If victim is conscious, give at least two glasses of water. DO NOT

INDUCE VOMITING. Seek medical assistance.

Skin Contact - Wash affected areas with soap and water. Wash soiled clothing before reuse.

Section VI - Health Hazard Data (cont.)

Severe Eye Contact - Flush eyes with water for 15 minutes. Seek medical attention.

Section VII - Precautions for Safe Handling and Use

Personal Protective Equipment (Routine Use):

Respiratory Protection : Airborne concentrations of chemical should be maintained as low as possible. If vapors or mists are formed, use NIOSH/MSHA approved air supplied respirator to prevent overexposure.

Gloves: Recommend latex, butyl rubber, or nitrile gloves.

Eye Protection: Safety goggles or glasses with face shield are recommended.

Other: Recommend Tyvek suits or coveralls.

Work Practices: This product may be used in indoor or outdoor environments. Exposures to hazardous components are not expected to exceed permissible limits during routine daily use.

Ventilation: If vapors or mists are generated, local exhaust ventilation is recommended.

Spill/Release Procedures: For major spills, call CHEMTREC 1-800-424-9300. Ventilate area and avoid breathing vapors. Use chemical cartridge respiratory protection and full protective clothing to clean large spills or spills in confined areas. Contain spill, and prevent entry into sewers and waterways.

Neutralization Procedures: Use 0.2-0.5% liquid detergent mixed with 3-8% Ammonium hydroxide or 5-10% sodium carbonate in water. Use 10 parts of solution for one part of Spill material. Allow 30 minutes to deactivate before placing spilled material into drums. Do not mix with any other waste material.

Waste Disposal Procedures: This material is not a listed hazardous waste, nor does it exhibit any hazardous waste characteristic.

Storage/Handling Procedures: Store product in a dry environment, away from strong bases and oxidizers. Do not place in contact with copper metal, copper alloys or zinc coated metals. Purge headspace in partially use container with dry nitrogen gas.

Section VIII-Transportation Information:

Bill of Lading description: Liquid, NOS, (MDI), NA3082, PGIII

END

EDF Title: PM-2A Half Tank Cover Supports

Project No.: 2000-096 | Discipline No.:

Project Title: PM-2A Tanks and Burn Pits RD/RAWP

Problem Statement:

A cover has been designed for dust control over the PM-2A tanks during sludge removal. A slight vacuum will be applied to the covered tank-half to maintain positive air-flow into the tank. These calculations are necessary to ensure cover support is sufficient to handle the vacuum loading.

Review and Approval Signatures:

	R/A	Typed Name/Organization	Signature	Date
Preparer		Kevin M. Shaber		12/3/03
Checker		KESLEY K. KIMMELL		12-3-3
Independent Reviewer				
Approver		GARY MECHAM		12/3/03

Summary of Conclusions:

The designed cover described in EDF-096-013 with the applied vacuum described in EDF-096-014 can be adequately supported with tie-downs connected to beams along the length of the tank. The tie-downs will be spaced at 12" and connected to S5x14.74 standard I-beams. This will maintain approximately 15 lbs tension on each tie-down and allow 2.3" of sag at the center of the tank.

Another potential method for holding-up the tank cover is to support the cover using small beams across the width of the tank. However, the associated difficulty with moving beams during the vacuum operation does not justify their use. The minor cover sag allowed with the tie-downs is less significant than the vacuum leaks that would be generated by the use of support beams under the cover.

Assumptions: The cover will be held in tension laterally and longitudinally by bungee cords and the pool cover cart. Total air flow is 2850cfm combined between the sludge removal vacuum and positive air-flow vacuum. Because volumetric flow under the cover is lower than that at the cover opening, the velocity head is lower and the pressure head is proportionally larger. Frictional losses along the length of the tank are neglected. Sag shape is approximated by a cylindrical curve and a centered point load. The centered point load is determined to be more conservative.

Distribution:

EDF Title: PM-2A Half Tank Cover Support Beams			EDF- 096-
Project No.: 2000-096			Rev No.:
Project Title: PM-2A Tanks and Burn Pits RD/RAWP			Page 2 of ?
Performer: Kevin M. Shaber	Date: 11/30/03	Checker:	Date:

Design Basis:

The half-tank cover is a Herculite 20 medium duty laminated fabric cover. The cover is held in place and positioned with a tank cover cart which has a five foot wide opening for sludge removal activities. This design file investigates the impact of air-flow induced vacuum on the tank cover and the necessary supports to prevent collapsing the cover. Cover tension to prevent sagging is provided by the tank cart and bungee cord supports along the length of the tank.

Assumptions:

All air flow will enter through the 5'x12.5' cart opening. This is a conservative assumption because the tank cover will have imperfect sealing along the tank length. Maximum airflow is 2850cfm governed by the capacity of the exhaust blower and sludge removal vacuum. Cover pressure will be only the velocity head of the exhaust blower across the tank-half area. The cover will be a Herculite 20 medium duty laminated fabric cover with a weight of 10.5oz/sq.yd. Cover tie-downs will be spaced every 12" along the length of the tank.

Calculations / Analysis:

With no beam supports under the cover, the cover will sag to absorb the load induced by the vacuum systems and its weight. The sag generates a tension proportional to the geometry of the sag which is held by the tie-downs. Approximately 2.3" of sag at the tank center will be held by the weight of S5x14.75 standard I-beams. Tied off at every 12", each tie-down will hold approximately 15lbs tension. This will provide good durability and ease of use for the operators.

Pressure differential is proportional to the square of the flow velocity per Bernoulli's equation for incompressible flow. The flow velocity for the tank cover calculations will be 22ft/min governed by 1350cfm blower flow across the 61.4ft^2 tank area. Total differential pressure is 4.8(10^{-4})psf. Cover weight is 7.3(10^{-2})psf.

Adding support beams under the cover can reduce some of the load held by the tie downs. However, two significant problems out weigh the benefits of support beams, and they are not recommended. The first problem is installation. Each beam must be pulled and replaced behind the cart as the cart is moved down the tank. The second problem is sealing. Each beam will create a significant air leak and could lower the face velocity below that necessary for dust control.

Attachments:

Design Calculations

INTREPID
Engineering Services, Inc.
A New Type of Engineering Company
501 West Broadway, Suite 200 Idaho Falls, ID 83402
(208) 529-5337

JOB

SHEET NO. OF

CALCULATED BY K. SHABER DATE 12/2/03

CHECKED BY DATE

SCALE

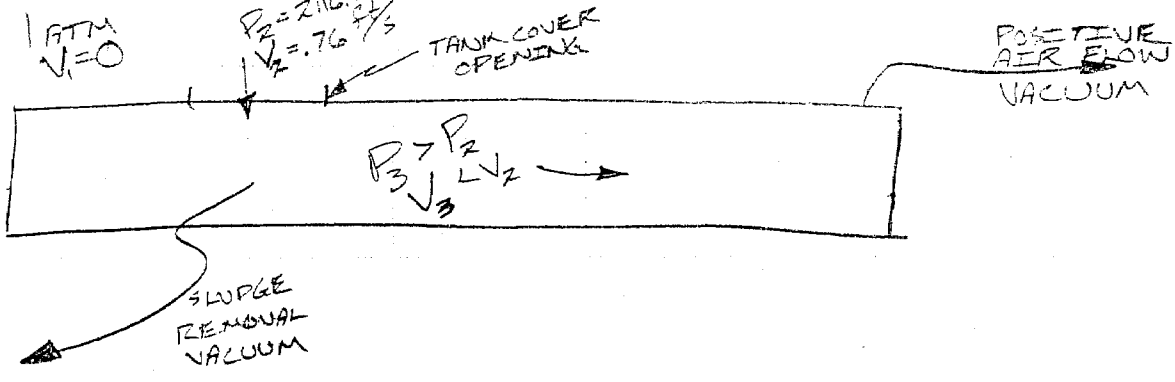
$$\frac{2116.8\ \text{PSF} - P_2}{.07528} = 1.5\frac{(.76^2)}{2(32.2)}$$

$$\Rightarrow P_2 = 2116.7990$$

$\Delta P = .001\ \text{PSF}$
$= 7.03(10^{-6})\ \text{PSI}$
$= 1.95(10^{-4})\ \text{IN}\ H_2O$

TOTAL ΔP AT TANK COVER OPENING

VELOCITY UNDER COVER IS REDUCED, PRESSURE INCREASED DUE TO AIR-FLOW INTO THE SLUDGE REMOVAL SYSTEM.



NO TRANSITION LOSSES FROM 2→3
$P_3 > P_2$ DUE TO TOTAL ENERGY BALANCE AND DECREASED VELOCITY.

INTREPID
Engineering Services, Inc.
A New Type of Engineering Company
501 West Broadway, Suite 200 Idaho Falls, ID 83402
(208) 529-5337

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

$$A_{\substack{TANK\\HALF}} = \frac{1}{2}\frac{\pi D^2}{4} = 8835.73\,in^2$$

$$= 61.36\,ft^2$$

$$\dot{V}_3 = 1350\,CFM \Rightarrow \boxed{V_3 = 22.0\,ft/MIN = .367\,ft/s}$$

$$\frac{\Delta P_{2-3}}{\rho} = K_L \frac{V_3^2}{2g} - \frac{V_2^2}{2g}$$

$$\Delta P_{2-3} = \frac{(V_3^2 - V_2^2)\rho}{2g} = \frac{(.367^2 - .76^2).07528}{2(32.2)}$$

$$\Delta P_{2-3} = -5.2(10^{-4})\,PSF$$

$$\Delta P_{1-3} = \Delta P_{1-2} + \Delta P_{2-3} = .001 - .00052$$

$$\boxed{\Delta P_{1-3} = 4.8(10^{-4})\,PSF = 3.35(10^{-6})\,PSI = 9.28(10^{-5})"\,H_2O}$$

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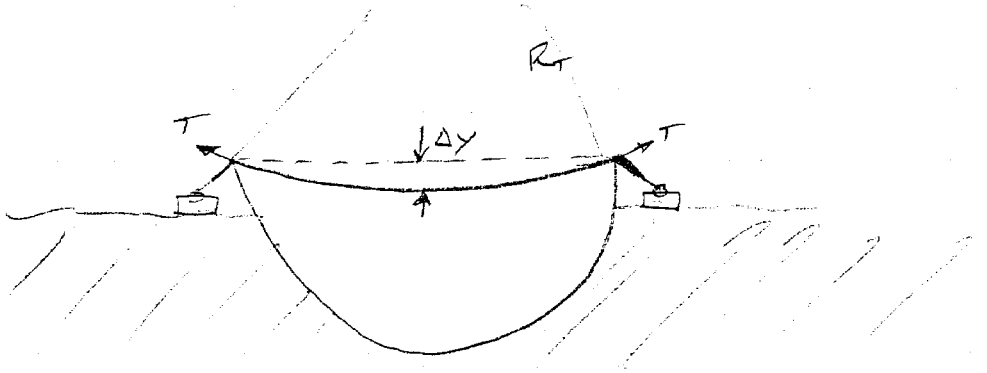
ELIMINATE TANK COVER SUPPORTS
(HOLD COVER PURELY W/ BOUNDARY TENSION)

COVER TIE-DOWNS SPACED @ 30" (s)

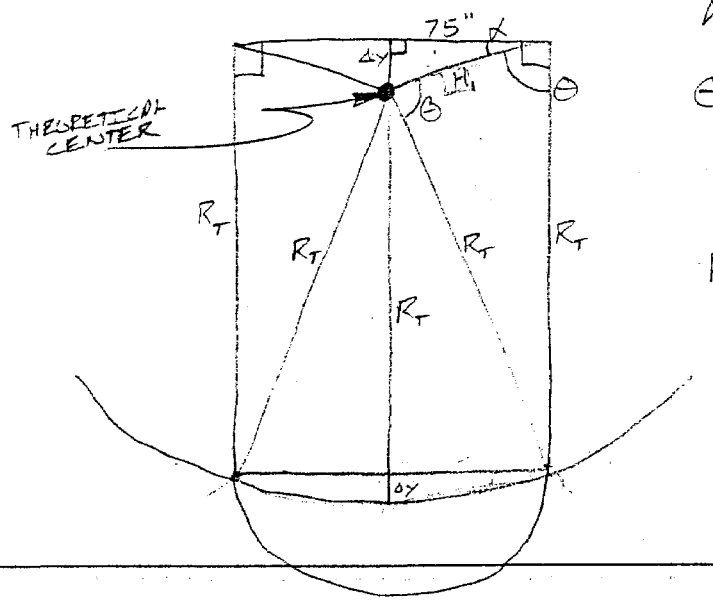
ASSUME CYLINDRICAL DEFLECTION



TENSION IN COVER (T) WILL APPROXIMATE TENSION IN A PRESSURE VESSEL W/ THE THEORETICAL RADIUS R_T

$$T = \frac{S\left(2R_T\Delta P_{1-3} + P_{CW}\right)}{2}$$

R_T:



$$\alpha = \tan^{-1}\left(\frac{\Delta Y}{75}\right)$$

$$\theta = 90 - \alpha$$

$$H_1 = \sqrt{75^2 + (\Delta Y)^2}$$

$$R_T = \frac{1/2\, H_1}{\cos\theta}$$

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WEIGHT O/ THE COVER (P_{CW})

$10.5 oz/yd^2$ ← HERCULITE 20 MEDIUM DUTY

$= .073 \, lb/ft^2$

$(5.06(10^{-4}) \, PSI)$

TENSION IS LIMITED BY THE WEIGHT O/ THE 4x6 BEAM HOLDING IT IN PLACE.

$P_W = 30.3 \, lb/ft^3$ (ROCKY MOUNTAIN DOUGLAS FIR @ 12% MOISTURE)

STANDARD HANDBOOK FOR CIVIL ENGINEERS 3RD ED.

4x6 NOM $\Rightarrow 3.5 \times 5.5 = 19.25 IN^2$

$A(30 IN) = 577.5 IN^3$

$= .334 \, ft^3$

MAXIMUM ALLOWABLE FORCE:

$T_{MAX} = 10.1 lb$

$$10.1 = \frac{30\left(3.35(10^{-4}) + 5.06(10^{-4})\right)}{2} \left(\frac{\frac{1}{2}\sqrt{75^2 + (\Delta Y)^2}}{\cos\left(90 - \tan^{-1}\left(\frac{\Delta Y}{75}\right)\right)} \right)$$

$$1321.95 = \frac{\sqrt{5625 + (\Delta Y)^2}}{\cos\left(90 - \tan^{-1}\left(\frac{\Delta Y}{75}\right)\right)}$$

$\Rightarrow \Delta Y = 4.26''$

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$T_{MAX} = W_L(2.5')$ $\quad W_L = 4.05\ lb/ft$ FOR NOM. 4x6 BOARD

$$\Rightarrow 327.2\ W_L = \frac{\sqrt{5625+y^2}}{\cos\left(90-\text{ATAN}\left(\frac{y}{75}\right)\right)}$$

USE S5x14.75 STANDARD I-BEAM

$W_L = 14.75$

$\Rightarrow \boxed{\Delta y = 1.17\ IN}$

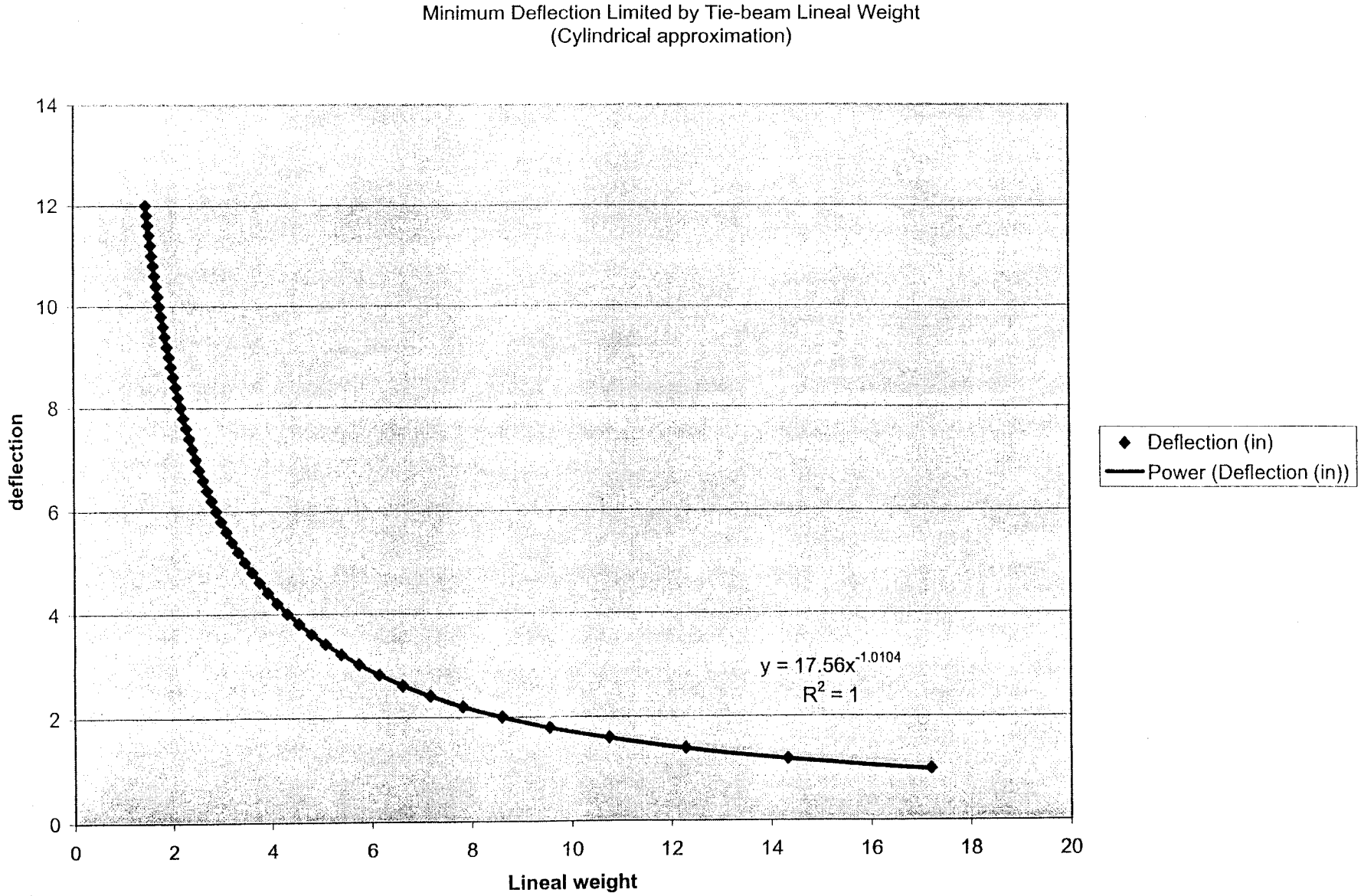
RECOMMEND S5x14.75 STANDARD I-BEAM OR SIMILAR WEIGHTED MEMBER

$\boxed{T_{MAX} = 14.75(2.5) = 36.9\ lb}$

REDUCE SPACING TO 1'

$\Rightarrow \boxed{T_{MAX} = 14.75(1) = 14.75\ lb}$ W/ S5x14.75 I-BEAM

$T_{MAX} = 4.05(2.5) = 10.13\ lb$ ← 4x6 BEAM


Minimum Deflection Limited by Tie-beam Lineal Weight
(Cylindrical approximation)
deflection
Lineal weight
0
2
4
6
8
10
12
14
16
18
20
y = 17.56x^-1.0104
R^2 = 1
Deflection (in)
Power (Deflection (in))

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JOB
SHEET NO. OF
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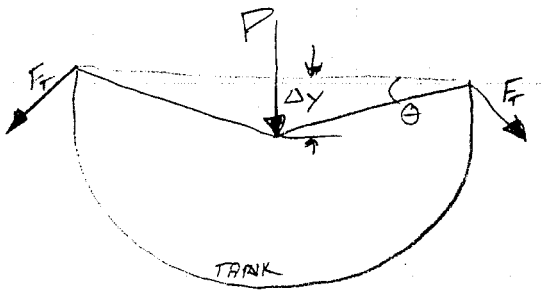
SCALE

ASSUME DEFLECTION AS IF A POINT LOAD @ CENTER O/ COVER



$$F_T = \frac{1}{2}\frac{P}{\sin\theta}$$

$$\theta = \text{ATAN}\left(\frac{\Delta Y}{75}\right)$$

$$P = (\Delta P_{1-3} + P_{CW})A$$

$$A = 150''(S)$$

S = TIE DOWN SPACING

ASSUME $S = 30''$

$$A = 4500\,IN^2$$

$$P = 4500\left(3.35(10^{-6}) + 5.06(10^{-4})\right) = 2.31b$$

$F_T = T_{MAX} = 10.13lb$ ← 4x6 WOODEN BEAM

$$10.13 = \frac{1}{2}\frac{2.3}{\sin\left(\text{ATAN}\frac{\Delta Y}{75}\right)} \Rightarrow \boxed{\Delta Y = 8.57''}$$ ← WOOD BEAM

$$\sin\left(\text{ATAN}\left(\frac{\Delta Y}{75}\right)\right) = \frac{2.3}{20.26} = .1135$$

MUCH MORE CONSERVATIVE ASSUMPTION

~~A~~ ASSUME $wt = 14.75\ lb/ft$ $\Rightarrow \boxed{\Delta Y = 2.34''}$ ← I-BEAM

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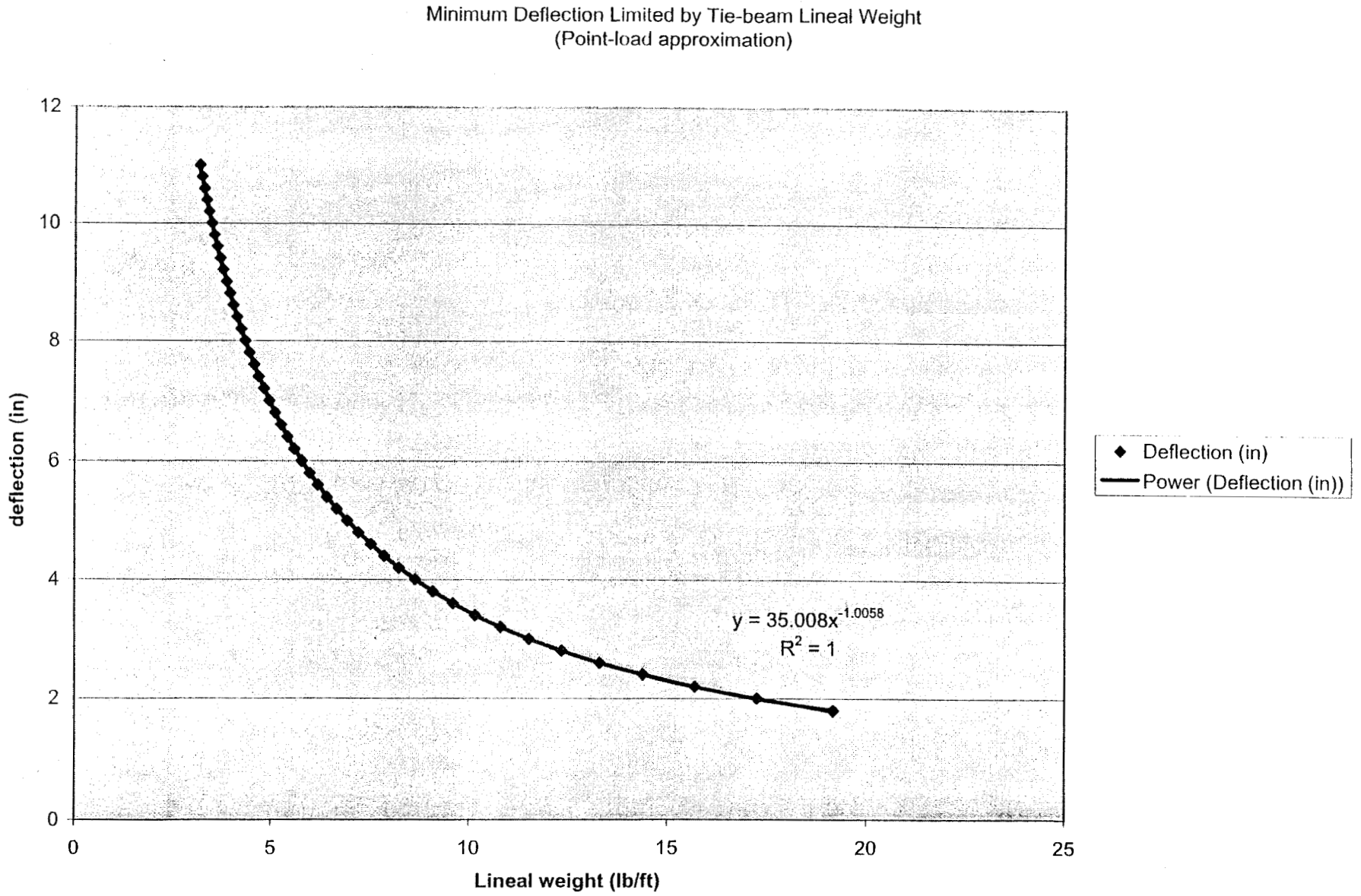
PER LINEAL WEIGHT:

$$2.5(W_L) = \frac{1}{2}\,\frac{2.3}{\sin\left(\text{ATAN}\left(\frac{\Delta Y}{75}\right)\right)}$$

$$\sin\left(\text{ATAN}\left(\frac{\Delta Y}{75}\right)\right) = \frac{.46}{W_L}$$

$$W_L = \frac{.46}{\sin\left(\text{ATAN}\left(\frac{\Delta Y}{75}\right)\right)}$$


Minimum Deflection Limited by Tie-beam Lineal Weight
(Point-load approximation)
deflection (in)
Lineal weight (lb/ft)
0
2
4
6
8
10
12
0
5
10
15
20
25
y = 35.008x^-1.0058
R^2 = 1
Deflection (in)
Power (Deflection (in))

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JOB PM-2A Half Tank Cover Vacuum
SHEET NO. 3 OF
CALCULATED BY Lowell DATE 12/1/03
CHECKED BY DATE
SCALE

$$P_2 - P_4 = \frac{V_3^2}{2g_c} - \frac{V_2^2}{2g_c} + h_f$$

$$P_2 - P_4 = \frac{(.366)^2}{2g_c} - \frac{(0,76)^2}{2g_c} + 3.67 \times 10^{-4}$$

$$= -.00651 \text{ ft of air,}$$

$$-P_4 = -P_2 - .00651 \text{ ft of air}$$

$$P_4 = P_2 + .00651 \text{ ft of air,}$$

$$P_4 = P_1 - .013 + .00651$$

$$P_4 = P_1 - .00649 \text{ ft air}$$

$$P_2 + \frac{V_2^2}{2g_c} = P_3 + \frac{V_3^2}{2g_c}$$

$$P_2 - P_3 = \frac{V_3^2}{2g_c} - \frac{V_2^2}{2g_c}$$

$$= \frac{(0,366)^2}{(2)(32.2)} - \frac{(0.76)^2}{(2)(32.2)} = -0.0069 \text{ ft of air}$$

$$P_3 = P_2 + .0069$$

$$P_3 = P_1 - .013 + .0069$$

$$P_3 = P_1 - .0061 \text{ ft of air,}$$

Differential head on cover = .0061 ft of air
Differential pressure = .0061 P = (.0061)(.075) = 4.575×10^{-4} lb/ft^2
Weight for 5' span = $(4.574 \times 10^{-4})(5)(12.5) = .029$ lbs,